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Graduate Earnings: An Econometric Analysis of Returns, Inequality and Deprivation across the UK

Main Report

Alan Ramsey, Analytical Service Group
Department for Employment and Learning
November 2008

GRADUATE EARNINGS: AN ECONOMETRIC ANALYSIS OF RETURNS, INEQUALITY AND DEPRIVATION ACROSS THE UK

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In this paper, we use the individual-level HESA data for the entire population of 2004/05 UK university undergraduates to investigate the determinants of graduate earnings. Our results suggest that there is likely to be considerable variability around the average rate of return to a university degree. Furthermore, we carry out, on a regional basis, an analysis of graduate deprivation and inequality in the UK, using techniques of modern economic analysis to assess the contribution of different population subgroups to overall inequality and poverty. Our analysis leads us to conclude that the level of graduate income inequality in the UK is actually quite low, with the substantial part of inequality the result of within-group as opposed to between-group inequality.

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1. Introduction and Literature Survey

With its now infamous declaration of "Education, Education and Education" the election in 1997 of the New Labour Government represented a watermark for the Higher Education (HE) sector. The past decade has witnessed unprecedented upheaval in almost every aspect of the sector driven, to a large extent, by the government's aspiration to see 50 per cent of all 18-30 year olds in HE by 2010. The desire to increase the proportion of young people attending some form of tertiary education has been fairly high up the agenda for most governments, going as far back as the 1960s. The post-Robbins[1] expansion in HE provision during the 1960s effectively marked the beginning of a revolution in HE participation in the UK. The trend continued through the 1980s with the removal of quotas on student numbers and again in the 1990s with the abolition of the binary divide. Chevalier & Conlon (2003) cite an increase of at least 50 per cent in the age participation index (API) in each of the decades from 1960 to 2000, such that, by 2000, 33.4 per cent of a cohort aged less than 21 was in full-time undergraduate studies compared to 5.4 per cent in 1960. In 2006 42 per cent of all 18-30 year olds (the current target age group) were in some form of HE.[2] Such large and rapid expansion in the UK graduate population is unique and not surprisingly has raised the issue of how such expansion is to be financed. In the last 10 years, the method of financing students through university has changed

[1] The Robbins Report was commissioned by the British government in the 1960s to look into the future of higher education in the United Kingdom. The Committee on Higher Education was chaired by Lord Robbins from 1961 to 1964. After its publication, its conclusions were accepted by the government on October 24, 1963

[2] HESA 2007

considerably, with a shift in the burden away from tax payers and onto students. The evidence base at the heart of this rebalancing has been an increasingly sophisticated analysis of graduate earnings, which show, surprisingly perhaps in light of the expansion referred to above, that the rate of return or 'returns' to HE have not fallen over time (see for example Machin (1999), McIntosh (2004) or Dearden *et al* (2005)). The social returns to HE, inherently more difficult to measure accurately, have tended to be not so well documented. Moreover, intuition would suggest that estimates of social returns are more likely to be under as opposed to over estimated due to the many non-calculated societal benefits. Consequently, it has become increasingly difficult and seemingly disingenuous to advocate a system of HE funded solely from the public purse. The recommendations of the Dearing Commission (1997) paved the way in 1998 for tuition fees for full-time UK students studying in HE. Dearing had found evidence of an average rate of return to a first degree of around 11% - 15%. Most recently the government introduced in 2006 a Graduate Contribution Scheme whereby universities are allowed to charge tuition fees up to a maximum of £3,000 per year for each course. There has been and continues to be much policy debate surrounding the funding of HE; should students incur any of the cost of their tuition - is it morally justified when a generation of graduates enjoyed a 'free' education? If one accepts the principle of graduate contribution then on what basis - variable or flat fees? The purpose of this paper is to investigate the nature and determinants of graduate earnings and, in particular, test the hypothesis that there is significant variation in the rate of return to a first degree

according to the characteristics of students and their chosen studies. The results will help to inform the funding debate. That flat fees have now been replaced by variable top-up fees across subjects and institutions makes the analysis all the more relevant. For example, as far back as 1997, Dolton, Greenaway and Vignoles[3], forseeing a shift towards variable fees, argued that an analysis of how returns to degrees vary by subject would become increasingly vital information for students.

Estimating the private 'rate of return' to education is a well-trodden area of applied economics evidenced by the extensive body of literature spanning the last three decades. Fortunately, Card (1999) and Heckman et al (2005) offer a recent survey of results and a critical assessment of the literature. The UK specific literature is well summarised in Blundell et al (1999) and by Chevalier and Walker (2001). In essence it is concerned with investigating the nature of the relationship between education and earnings, in particular, the impact of an additional years schooling on wages. The earnings premium associated with an additional years schooling can be thought of as the 'rate of return' to the additional year. Looking specifically at the HE sector, economists, graduates and policy makers are interested in the earnings premium associated with university-level qualifications, that is, the graduate premium. The conventional approach is to base estimates of the premium on a comparison of two individuals; one who went to university relative to someone who could have gone to university but

[3] Dolton, P.J., Greenaway, D. and Vignoles, A. (1997), "Whither Higher Education? An Economic Perspective for the Dearing Committee of Inquiry", Published in The Economic Journal, May 2007.

chose not to do so. In all other respects the individuals must be assumed identical. Generally the comparator role is filled by an individual whose highest qualification is two or more A-Levels. So, for example, Blundell, Dearden, Goodman and Reed (2000) use British birth cohort panel data from the National Child Development Survey (NCDS) to examine the impact that degree level qualifications have on earnings. They find average returns to a first degree of around 17% for men and 37% for women, where the comparator group are those men and women who obtained at least two A Level qualification but did not proceed to university. More recently, Blundell, Dearden and Sianesi (2003), have estimated an average earnings premium associated with obtaining a HE qualification of approximately 23.5 per cent. They translate this into a net additional lifetime earnings premium of £120,000. That is, in monetary terms and according to their methodology, the average graduate can expect to earn an additional £120,000 over a working lifetime compared with an individual with two or more A-levels.

We should also note however that estimating the returns to HE whilst popular is notoriously difficult and the accuracy of the results only ever as good as the data and the methodology employed.[4] In respect of the former, earnings data can be a problem in most datasets. Individuals are often reluctant to provide salary information resulting in a high proportion of missing observations, which can drastically reduce sample size and ultimately estimation precision. As a consequence many researchers have preferred to rely on the individual's reported occupation and match this to the corresponding gender-specific SOC

[4] Weale (1993) offers an in-depth critique of the methodological literature.

occupational earnings as reported by the Office for National Statistics. See, for example, Smith and Naylor (2000a) who merge occupation information from the Universities Statistical Records (USR) with occupational earnings data from the New Earnings Survey (NES) to investigate the determinants of degree performance. The quantitative techniques employed to estimate the returns to education are necessarily complex, mainly because it is inherently difficulty to disentangle the 'pure' effects of time spent in HE on wages, from the influence of other exogenous factors that affect earnings. To illustrate this point consider the simple human capital model in a competitive labour market. The wage received by the i^{th} individual, w_i, should reflect his productivity which in turn is determined by his stock of human capital, H_i. This stock is not observed but is taken to be a function of the number of years schooling, S_i, the individual has undertaken. Then the simplest model to estimate the effect on wages of schooling, that is, the return to education, is to run a regression based on the standard log-wage model as proposed by Mincer, 1974:

$$\ln w_i = \alpha + \beta S_i + \varepsilon_i \qquad (1)$$

Then standard Ordinary Least Squares (OLS) estimation is consistent only if the model is correctly specified. However, this simple expression ignores the non-educational characteristics of individuals, characteristics which influence earnings. Individual ability, A_i, is an obvious example. "Ability….is an unobserved latent variable that both drives people to get relatively more schooling and earn more income, given schooling, and perhaps also enables and

motivates people to score better in various tests" (Griliches, 1977). Thus instead of (1), the actual model, provided that ability is the only omitted variable, would be:

$$\ln w_i = \alpha + \beta S_i + \gamma A_i + \varepsilon_i \tag{2}$$

The fundamental problem is that ability exerts an influence on the level of schooling and, for any level of schooling, will influence the wage. Generally, ability is not observed and if (2) is correct but (1) is estimated to yield b_{ols} then the procedure will suffer from omitted variable bias:

$$E[b_{ols}] = \beta + \gamma \frac{\text{cov}(A, S)}{\text{var}(S)} \tag{3}$$

Anticipating that $\gamma > 0, \text{cov}(A, S) > 0$ then the omission of ability yields a positive bias to b_{ols}. This measurement error problem in estimating the returns to education arises as a consequence of missing data. Many of the characteristics of individuals that affect their HE outcome are unobservable and therefore are omitted from the log-wage equation. However, since these variables, such as ability, motivation, rate of time preference etc, are also correlated with wage outcomes, the OLS estimates of the impact of education on wages will be biased. Tracing the literature from the 1960s through the decades it is evident that as econometric modelling techniques have advanced increasing emphasis has been placed on controlling for these potential problems. Blundell *et al* (1999) observe that "most of the early studies of the returns to education ignored such things as

ability and measurement error bias". Increasingly more sophisticated methods are employed to ensure that the wage equation reflects personal, family and ability characteristics as fully as possible.

So where does this paper sit in relation to the existing literature and how does it add to the existing knowledge base? Let's recall, as was outlined above that estimating the returns to education is inherently difficult; firstly, there is generally an absence of reliable data, in particular earnings data. Secondly, the issue of simultaneity between schooling and earnings creates bias in the standard OLS estimates. Thirdly, the control group of non-graduates against which the graduate premium is calculated exists in fewer and fewer numbers as nearly all students achieving 2 A Levels or more now go into HE. These difficulties are not insurmountable and have in fact encouraged new and innovative approaches; Borooah (2007) for example, adopts a measure of returns to education based on the probability of "labour market success" associated with different levels of qualification. Two measures of "success" are used based on data from the 2001 UK Census for the different regions of the UK: first, the likelihood of persons in employment being in "good" jobs; second, the likelihood of persons in the labour force being in employment. The results show that, in every region of the UK, better qualifications are significantly and strongly associated with higher probabilities of labour market success. However, wary of the pitfalls and in light of the already extensive literature on rate of return analysis the purpose of this paper is not to estimate the returns to HE but rather to investigate the variation or heterogeneity in the average earnings of graduates and consider what inference,

if any, we can make in relation to the 'rate of return' to a first degree. Heterogeneity is a theme which runs through the literature and in particular relates to gender, subject of study, degree classification, Higher Education Institution and region of employment. The literature is fairly conclusive that the return to a degree is much greater for women than for men. Walker and Zhu (2001) use Labour Force Survey (LFS) data to find that men in the UK in possession of a first degree enjoyed an earnings premium of approximately 15% over individuals in possession of A-levels. The corresponding estimate for women was 19%. Dearden, McGranahan and Sianesi (2005) using the British Cohort Study (1970) support these findings and in fact suggest a figure for women of 22% over and above a female with only A-levels. Amongst others, Blackaby, Murphy and O'Leary (1999), Blundell et al (2000), Walker and Zhu (2003) and O'Leary and Sloan (2005) have found evidence of substantial variation in the returns across subject of study even after controlling for personal and non-educational characteristics. PricewaterhouseCoopers (2005) for example, find an average return to a first degree of 23%. However, the variation by subject is significant; medicine and law graduates achieve a premium of 44 and 39 percent respectively whilst linguistics and history graduates achieve a premia of 15 and 13 percent respectively. The interplay between the influences of gender and subject on returns is emphasised in Walker and Zhu (2001). They show that "men in possession of mathematics degrees achieved a 25.7% earnings premium over those with A-levels as their highest qualification, while corresponding women achieved a 38.6% earnings premium."

Variation in the returns to a degree according to the class of degree awarded has been fairly well covered in the literature. Blundell, Dearden, Goodman and Reed (2000) use the British Cohort Study (BCS70) to show that, in general, there is evidence of higher returns for students with higher university attainment. That given, Battu, Belfield and Sloane (1999) and Naylor, Smith and McKnight (2003) have found substantial variation in returns by degree classification. The former uses longitudinal comparisons from a survey of graduates from two cohort years (1985 and 1990) to find that class of degree has a significant effect on graduate earnings up to eleven years after graduation.[5] The latter shows that even for graduates surveyed only six months after graduation (using FDS data[6]), there is a spread in average earnings of around 12% between the earnings associated with a first and those associated with a third class degree. The issue of variation in returns by institution type is not so well covered in the literature; one of the few studies is Chevalier and Conlon (2003). They use survey data of UK graduates from 1996 and 1998 to estimate the returns to undergraduates for four types of higher education institution: the Russell Group, 'old' universities; polytechnics; and 'other institutions'. They find statistically significant wage premia associated with Russell Group institutions relative to new universities; "even after accounting for personal characteristics graduating from a Russell Group institution adds between 0 and 6% [2.5%] to a male [female] graduate's earnings compared to graduating from a Modern university." Naylor, Smith and McKnight (2002) using

[5] The data used are from a survey organised by the University of Birmingham in the winter of 1996. The survey collected information from panels of graduates across the UK and from a range of HEIs from the academic year cohorts of 1985 and 1990. The survey asked graduates to provide information on, *inter alia*, salary, sector and occupation of employment, at dated intervals: 1986, 1991 and 1996.
[6] First Destinations Survey (predecessor to the Destinations of Leavers from Higher Education Survey.

the First Destinations Survey for the 1992 graduate population find some evidence of variation in returns by institution, albeit not very large, concluding that more than 80 per cent of institutions lie within 5 per cent of the mean effect. O'Leary and Sloan (2006) examine heterogeneity in returns across British regions using the Labour Force Survey. They find substantial variation in graduate earnings by region, although they find that adjusting for cost-of-living and controlling for both occupational and industrial structures narrows such differences considerably.

This research exploits information from the administrative records for the whole population of students leaving UK universities in 2005, combining this information with the employment and salary information obtained six months after graduation in the form of the Destination of Leavers from Higher Education Survey (DLHE)[7]. It will be possible to analyse the determinants of graduate earnings and isolate the effects of *inter alia,* gender, subject of study, degree classification, university attended and other student and course-related characteristics. The cross-sectional and longitudinal survey datasets employed by researchers investigating the returns to a degree – many of which are referred to above - are typically hampered by a lack of sufficient data on these key characteristics. Either the appropriate questions are not asked or the samples are too small to facilitate robust analysis. Consequently the student record information held by HESA must be seen as a particularly rich data source, providing complete coverage of the whole cohort of university leavers in any one year. So, for example, the

[7] DLHE survey replaced the First Destinations Survey for 2002/03 leavers. Individual institutions send out questionnaires, conduct telephone surveys and collate responses before submitting the data to HESA where it is validated and linked to the student record.

2004-05 data pertains to 430,290 leavers from UK Higher Education Institutions. It records high quality administrative information on students' key academic characteristics: such as, degree subject, university attended and degree classification, which - unlike many of the datasets already mentioned - allows detailed analysis of variation in earnings by these key variables. Using such a rich set of observable information will help to control for unobservable characteristics, reducing the risk of bias and increasing the precision of estimates. Employment circumstances and earnings information for the 2004/05 graduate population are captured by DLHE 2004/05. The HESA data is limited in a couple of respects; it does not contain data on the previous institution attended nor the A-level subjects of the students, it does however include information on each graduate's overall A-Level score. Furthermore, the nature of the data collected is such that it does not contain information on a sample of non-graduates and therefore there is no control group against which to estimate the rate of return to a first degree. Hence our concern is not to estimate the rate of return rather to produce estimates of the average earnings variation associated with the key variables of interest as identified above, for example, the variation in average earnings by gender, subject, institution, degree classification and region. Naylor, Smith and McKnight (2003) suggest that these variations may be interpreted as a proxy for the magnitude of variation in the returns to a first degree.

The structure of the paper is as follows. Section 2 describes the data and the modelling strategy. Section 3 presents and discusses the results from OLS

estimation of the determinants of graduate earnings for the 2005 cohort. Section 4 presents an analysis by inequality decomposition. Section 5 applies deprivation techniques to the graduate income data and, finally, Section 6 presents conclusions and closing remarks.

2. Data and modelling strategy

The data in this paper is based on the individual-level information collected by the Higher Education Statistical Agency (HESA)[8] and relates specifically to two data sources. The first is 'Students in Higher Education Institutions' which reports administrative records for the entire UK student population in any particular academic year, in this case 2004/05. It includes information at the institutional level about entry qualifications, programmes taken, and outcomes, together with student characteristic variables such as age, gender, ethnicity, and disability. Secondly, the 'Destinations of Leavers from Higher Education Survey' (DLHE) which provides information about patterns of employment and further study or training at a point about six months after completion. It is from the student record collection that the list of qualifiers eligible to be included in the DLHE is constructed. The DLHE survey covers leavers from part-time as well as full-time programmes and covers data supplied by 168 UK Higher Education Institutions[9], it is however limited to those of UK and other EU domicile. The leavers included in the 2004/05 survey are those who completed their programmes during the 2004/05 academic year, that is, the period 1 August 2004

[8] HESA collects data from publicly funded HEIs in the UK on behalf of funding bodies and government departments, in a framework underpinned by legislation.
[9] 132 in England, 12 in Wales, 20 in Scotland, 4 in Northern Ireland.

to 31 July 2005. We merge information from the DLHE into the student record data.

Before continuing it is important to briefly outline the data merging process and in particular the difficulties encountered. In order to have a final dataset for analysis three separate datasets had to be reconfigured and merged. Firstly, given that we are only interested in the flow of qualifiers we do not need the entire student record collection for 2004/05. Thus the first dataset pertains to the student records for the DLHE target population – the sub-population who qualified in 2004/05 and is therefore eligible to receive a DLHE Survey – of which there were 430,290. The second dataset is a subject file that, for each individual, contains information on subject. This information is held in conjunction with but not as part of the actual student record dataset. Finally, the DLHE dataset containing some 319,260 responses from 430,290 qualifiers, representing a survey response rate of approximately 75%. HESA assign each student with a unique 13-digit student number making it possible to track a student across each dataset. However, since a student can qualify with something other than a single subject combination, they can appear more than once on the subject file. For example, someone qualifying with a major/minor (triple) combination will appear twice (three times) in the subject file, where they can only appear once in both of the other files. Consequently, this creates difficulties when merging the files into one master dataset, the student number represents the only common or linking variable across the files; however, it can have multiple occurrences within the subject file. The result is that in a merge procedure only one occurrence will be

picked up with the information relating to the other occurrence(s) being lost. So for example, in this instance, since the multiple occurrence lies in the subject file, we will lose the information relating to the second and/or third subject. Consider a BA (Hons) Fashion and Journalism qualifier. Fashion and Journalism represent two separate JCAS codes[10]; Fashion is defined under Creative Art & Design and Journalism under Mass Communication and documentation. Thus, this qualifier will appear twice in the subject file. By merging the individual's records across three files he/she will be incorrectly recorded as either a Fashion graduate or a Journalism graduate, not a combination. Since only a relatively small proportion (13.16%) of 2004/05 leavers qualified in more than one subject area (i.e., with balanced, major/minor or triple combinations) these were removed before merging, leaving 373,669 records.

Merging across three files further reduces the number of observations to 277,471, that is, we have comprehensive student characteristics, subject and labour market outcome data on 277,471 leavers from UK Higher Education Institutions in 2004/05. Of these we are particularly interested in the 146,527 students who were registered for and successfully completed a full-time first undergraduate degree. Further, we restrict the analysis by omitting medical students as there is essentially no variation in their reported main activity on leaving university[11]: almost all these graduates enter the medical profession, with 80% registered as health professionals six months after graduation.

[10] HESA defines subject areas in terms of JCAS codes. See Annex A for a full definition.

[11] A total of 130,944 observations are dropped from the merged file, the breakdown is as follows:
Part-Time qualifiers: 56,188
Other undergraduate and Postgraduate qualifications: 69,492

Of the 64,820 male graduates, 14% were unemployed or inactive six months after graduation, 16% were in further study whilst 59% were in paid employment. Of the 81,707 female graduates, 10% were unemployed or inactive, 16% were in further study whilst 62% were in paid employment. From a total of 88,740 graduates in employment 40,296 (45%) provided salary information.

In order to investigate the determinants of graduate earnings this paper will analyse the relationship between earnings and the various sets of individual student characteristics available from the student records data, both of which, along with subject information, have been merged into one data source. The principle variables can be categorised as set out in Table 1. As was outlined in Section 1 many studies within the 'returns' literature have been hampered by a lack of reliable earnings data. Fortunately the DLHE survey records individual starting salaries, collected to the nearest £1,000. In the absence of this information we could have matched an employed graduate's reported occupation to the corresponding gender-specific 3-digit SOC average occupational earnings from the Annual Survey of Hours and Earnings (2005). The problem with starting salary information is that it is generally considered to be a poor proxy for career earnings. Undoubtedly occupational earnings,

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Unsuccessful completion: 314
Medical/Dentistry qualifiers: 4,950
leaving 146,527 observations.
See Annex B for a full definition of each category.

Table 1: Key Variables

1. Personal Information	• Age at graduation • Gender • Marital status • Ethnicity • Disability • Fee eligibility • Country of domicile • Socio-economic classification
2. Academic Information	• Highest qualification on entry • Total tariff score[12] • GCE A-level tariff score • Scottish Higher tariff score • Course for which admitted
3. Annual Information	• HEI attended • Subject of study • Duration of programme • Type of course • Method of study inc. FT or PT, qualification aim and source of fees
4. Leavers Details	• Level of qualification obtained • Class of degree awarded • Reason for leaving • Employment circumstances • Standard occupational classification • Standard industrial classification • Location of employment • Starting salary

[12] Qualifications are equalised

which are summed over each individual in an SOC class, are a more accurate reflection of career earnings. However, SOC occupational earnings data do not allow for within occupation analysis; starting salaries give an extra layer of detail, which can be used to capture intra-occupational differentials arising between different types of graduate within occupations. In January 2009 HESA plan to conduct a follow-up survey on a sample of 2004/05 leavers who responded to the 04/05 DLHE. This longitudinal data will help to address some of the issues associated with surveying graduates after six months. It should produce information more closely aligned to the early career trajectories of the 2004/05 cohort and represents an exciting direction in which to develop this research.

Methodology

In this paper, we use standard Ordinary Least Squares (OLS) estimation to estimate gender-specific earnings equations for the 17,298[13] 2005 UK university leavers employed and for whom we have a complete data profile. The dependent variable is the natural logarithm of salary; the regressors are a mixture of dummy, continuous and interaction variables. Regression analysis allows us to account for the variance in log-earnings, based on a linear combination of these dummy, continuous and interaction variables. The classical log-linear regression model takes the form:

$$\ell Yj = \alpha + \beta_1 X_{1j} + \beta_{2x} 2_j + ... + \beta_k X_{kj} + \varepsilon j = \alpha \sum_{i=1}^{k} \beta_i X_{ij} + \varepsilon j = E(Y_j \mid X) + \varepsilon j \qquad (1)$$

[13] 22,998 graduate observations are lost due to incomplete data profiles, for example, only 46% provided SEC information.

Where, assuming that the following conditions hold:

- Linearity: $y_i = x_{i1}\beta_1 + x_{i2}\beta_2 + ... + x_{iK}\beta_K + \varepsilon i$. The model specifies a linear relationship between y and $x_1,..., x_K$.
- Full Rank: There is no exact linear relationship among any of the independent variables in the model. This assumption is necessary for estimation of the parameters of the model.
- Exogeneity of the independent variables: $E[\varepsilon i \mid x_{j1}, x_{j2},..., x_{jK}] = 0$. This states that the expected value of the disturbance term at observation *i* in the sample is not a function of the independent variables observed at any observation, including this one. This means that the independent variables will not carry useful information for prediction of ε_i.
- Homoscedasticity and nonautocorrelation: Each disturbance, ε_i has the same finite variance, $\sigma 2$ and is uncorrelated with every other disturbance, ε_j.
- Exogenously generated data: The data in $(x_{j1}, x_{j2},..., x_{jK})$ may be any mixture of constants and random variables. The process generating the data operates outside the assumptions of the model - that is, independently of the process that generates ε_i.
- Normal distribution: The disturbances are normally distributed.

Then the Gauss-Markov Theorem holds true, that is, the least squares estimator **b** is the minimum variance linear unbiased estimator of ***β***. Regression results are presented in Section 3.

2.2 Descriptive Statistics

Descriptive statistics are presented in Tables 2 through 6 and in figures 1, 2, 3 and 4. These relate to the 40,296 first degree graduates who were in employment and had identified salary information six months after graduation. Table 2 presents summary statistics for the main explanatory variables used in the analysis. All figures are proportions apart from 'A-Level score', which is a mean value. Tables 3, 4, 5 & 6 and figures 1, 2, 3 & 4 describe graduate earnings in terms of the key variables of heterogeneity as outlined in Section 1, that is, by gender, by subject, by degree classification, by Institution and finally by region.

Table 2: Summary Statistics

	FEMALE	MALE
Variable	Proportion	Proportion
	Academic Background	
Previous quals		
A-levels/SCE Highers	0.75	0.78
HND/HNC	0.04	0.06
OND/ONC	0.02	0.03
Access course	0.02	0.01
No formal qual	0.00	0.00
Other qualification	0.17	0.12
A-levels		
Score	144	134
Total Tariff		
Score	303	299
	Personal characteristics	
Age<24	0.78	0.82
Age 24-27	0.09	0.11
Age 28-33	0.04	0.03

Age 34+	0.09	0.03
Disability	0.06	0.07
	FEMALE	MALE
Variable	Proportion	Proportion
Overseas Student	0.02	0.02
SEC 1	0.54	0.56
SEC 2	0.17	0.16
SEC 3	0.07	0.07
SEC 4	0.05	0.05
SEC 5	0.16	0.16
SEC 6	0.00	0.00
High SEC	0.72	0.72
Low SEC	0.28	0.28
White	0.89	0.88
Black	0.02	0.02
Asian	0.07	0.08
Mixed	0.02	0.02
	Degree Classification	
First	0.11	0.13
Upper second	0.53	0.46
Lower second	0.27	0.32
Third	0.03	0.04
Other classification	0.05	0.05
	Higher Education Institution	
Old	0.21	0.23
New	0.52	0.50
Russel	0.20	0.23
Other	0.05	0.03

The key points from table 1 are as follows:

- Female (male) graduates account for 59% (41%) of the sample;
- Around three quarters (76.5%) of graduates took A-levels or Scottish Highers prior to university with an average A-level score of around 140[14] points;
- 80% of individuals were aged less than 24 at graduation;
- Just over 6% of graduates have a disability, half of which is accounted for by dyslexia;
- Just under half of the sample identified socio-economic classification (18,434), of which approximately one in four graduates came from a low socio-economic group. Over half (55%) came from professional and managerial households;
- There are 8 white for every Black, Asian or Mixed individual within the sample;
- 11% (13%) of female (male) students graduated with a first class degree, 53% (46%) with an upper second class and 27% (32%) with a lower second class
- Approximately half (51%) of students graduated from 'new universities'[15]

[14] 'A' level scores are computed according to the new system, which counts an 'A' grade as 120 points, 'B' as 100 points, 'C' as 80 points, 'D' as 60 points, 'E' as 40 points.
[15] 'Old universities' are those established before 1992. 'New universities' include former polytechnics and HE degree-awarding colleges created with the abolition of the binary divide in 1992. Russell Group is an association of 20 major research-intensive universities in the UK. 'Other' institutions include, in the main, university satellite colleges not elsewhere defined. See Annex I for a full list of each.

Table 3a: Average Starting Salary by Gender and Degree Subject Group (£/wk)

	FEMALES			MALES		
Degree Subject	Mean	Std. Dev	N	Mean	Std. Dev	N
Subjects allied to medicine	361.29	83.11	4,805	363.5	122.84	766
Biological sciences	280.77	95.15	2,942	287.39	95.49	1,244
Veterinary sciences	412.63	91.68	129	416.61	79.21	52
agriculture & related subjects	282.03	82.38	320	311.68	86.2	153
Physical sciences	290.00	89.75	830	326.22	115.77	998
Mathematical sciences	343.93	114.57	223	383.27	186.33	297
Computer sciences	342.39	201.79	522	363.04	130.72	2,398
engineering & technology	358.03	114.15	400	382	177.91	2,249
Architecture, building & planning	340.16	126.60	220	371.31	116.98	636
Social studies	321.39	105.92	2,227	355.63	142.88	1,414
Law	295.57	95.10	676	327.15	162.03	326
Business & administrative studies	314.90	124.34	3,448	340.37	137.05	2,568
Mass communication & documentation	283.87	77.51	957	283.49	91.62	500
languages	287.19	97.52	1,482	293.61	116.84	422
Historical & philosophical studies	293.79	111.27	911	301.26	147.67	721
creative arts & design	263.29	97.38	2,410	291.93	185.48	1,463
Education	345.24	94.85	1,211	349.8	247.45	183
Combined	266.94	90.77	142	296.25	93.13	51
Total	**313.41**	**108.51**	**23,855**	**339.59**	**148.04**	**16,441**

Source: HESA

Table 3b: Average Starting Salary by Gender, Degree Subject Group and Higher Education Institution (£/wk)

	FEMALE					MALE				
Degree Subject	Old	New	Russell	Other	All	Old	New	Russell	Other	All
Subjects allied to medicine	346.33	370.36	350.68	364.65	361.29	347.79	379.03	341.06	401.42	363.5
Biological sciences	284.44	274.16	288.40	255.77	280.77	294.59	284.78	287.31	283.33	287.39
Veterinary sciences	.	324.36	424.24	.	412.63	.	269.23	419.50	.	416.61
agriculture & related subjects	298.37	272.72	294.92	288.51	282.03	302.38	316.28	273.08	319.81	311.68
Physical sciences	296.24	275.26	297.99	240.38	290.00	326.21	306.10	337.43	480.77	326.22
Mathematical sciences	316.70	319.23	376.39	211.54	343.93	356.74	375.38	405.58	.	383.27
Computer sciences	349.68	333.16	411.50	326.92	342.39	376.60	345.51	415.00	295.02	363.04
engineering & technology	365.13	309.52	409.28	332.42	358.03	383.19	358.95	410.85	351.87	382
architecture, building & planning	361.24	351.36	313.46	355.77	340.16	389.46	369.64	369.29	303.57	371.31
Social studies	315.06	324.12	325.58	292.94	321.39	354.08	326.56	386.27	304.16	355.63
Law	294.99	290.48	310.18	241.76	295.57	327.48	320.34	336.23	269.23	327.15
Business & administrative studies	327.90	310.22	353.00	291.70	314.90	360.04	330.44	384.67	310.65	340.37
Mass communication & documentation	274.59	283.39	296.98	297.93	283.87	278.23	283.09	310.17	265.47	283.49
languages	286.31	268.21	301.73	261.90	287.19	296.70	260.97	303.81	278.85	293.61
Historical & philosophical studies	297.44	259.64	306.51	286.54	293.79	295.22	264.06	326.80	437.50	301.26
creative arts & design	265.12	263.87	262.61	257.46	263.29	305.24	293.40	245.35	286.57	291.93
Education	360.79	341.92	338.09	350.63	345.24	365.38	353.14	326.30	358.81	349.8
Combined	311.70	254.72	266.56	.	266.94	372.60	272.18	302.47	.	296.25
Total	309.64	311.81	323.09	306.36	313.41	346.03	326.80	365.10	310.96	339.59

Table 3a shows average earnings, disaggregated by gender and by degree subject area six months after graduation. Individual salaries are reported to the nearest £1,000 and are, for the purposes of this paper, divided by 52 so as to represent gross weekly earnings. The table also shows the number of observations for each subject. For the whole sample, mean earnings of males were £339.59 per week, with mean earnings of females at £313.41, equal to 92% of the average for males. The standard deviation in earnings is very large and varies considerably by subject: it is particularly large for computer science, for example. Degree subject areas associated with relatively high gross weekly earnings were: veterinary sciences, subjects allied to medicine and engineering and technology.[16] The ranking of subjects is broadly similar for men and women; veterinary science and engineering & technology graduates recording high earnings in comparison to creative arts & design and biological science graduates at the other end of the scale.

Table 3b is a representation of Table 3a and Figure 2 (below), which looks at earnings in terms of the interaction between gender, degree subject and university-type. For male graduates there is a clear ordering of earnings by university-type whereby 'Russell' graduates enjoy on average 12% higher earnings 'new' graduates. For females the trend is not so clear; 'Russell' university graduates are the highest earners but 'old' and 'new' university graduate earnings are broadly similar, with 'new' female graduates slightly higher earners. From Table 3b we can further breakdown the earnings differential by

[16] The classification of subject used in table 3 is consistent with the 19 JACS 'subject areas'. Much finer subject group disaggregations give a more accurate picture of the raw earnings differentials across subjects. These are presented in Annex C across the 143 JACS 'principle subjects'.

broad subject area. So, for example, the data show that female graduates who undertook a Mathematical Science (Computer Science) degree at a Russell Group university earn 19.0% (17.7%) more than a female undertaking the same degree at an Old university. Conversely, female Architecture, Building & Planning 'Russell' graduates earn 13.2% less than their Old university counterparts. For males, it appears to be 'Historical and Philosophical Studies', 'Computer Science' and 'Social Studies' graduate earnings that are most sensitive to university-type and, vice versa 'Creative Arts & Design' and 'Agriculture'.[17] In respect of the former (latter), 'Russell' graduates display on average, 23.8%, 20.1% and 18.3% (-16.4% and -13.7%) higher earnings, respectively, over their 'new' university contemporaries.

Figure 1 and Figure 2 shows that there is substantial variation in average starting salary across universities. Mean earnings of graduates from the university ranked lowest in the distribution were around one third of the level at the highest ranked university. Furthermore, Figure 2 as alluded to above, shows that on average, the 21% of graduates from the elite Russell Group of universities enjoy a small earnings perk over their counterparts; 7.6% (5.0%) over 'old' graduates ('new' graduates), with significant variation by gender and degree subject area therein.

[17] In fact 'Veterinary Science' is most sensitive with an earnings differential of 55.8% between Russell and New university graduates, however, the sample size is extremely small (52 Obs).

Figure 1: Distribution of individual starting salaries across universities

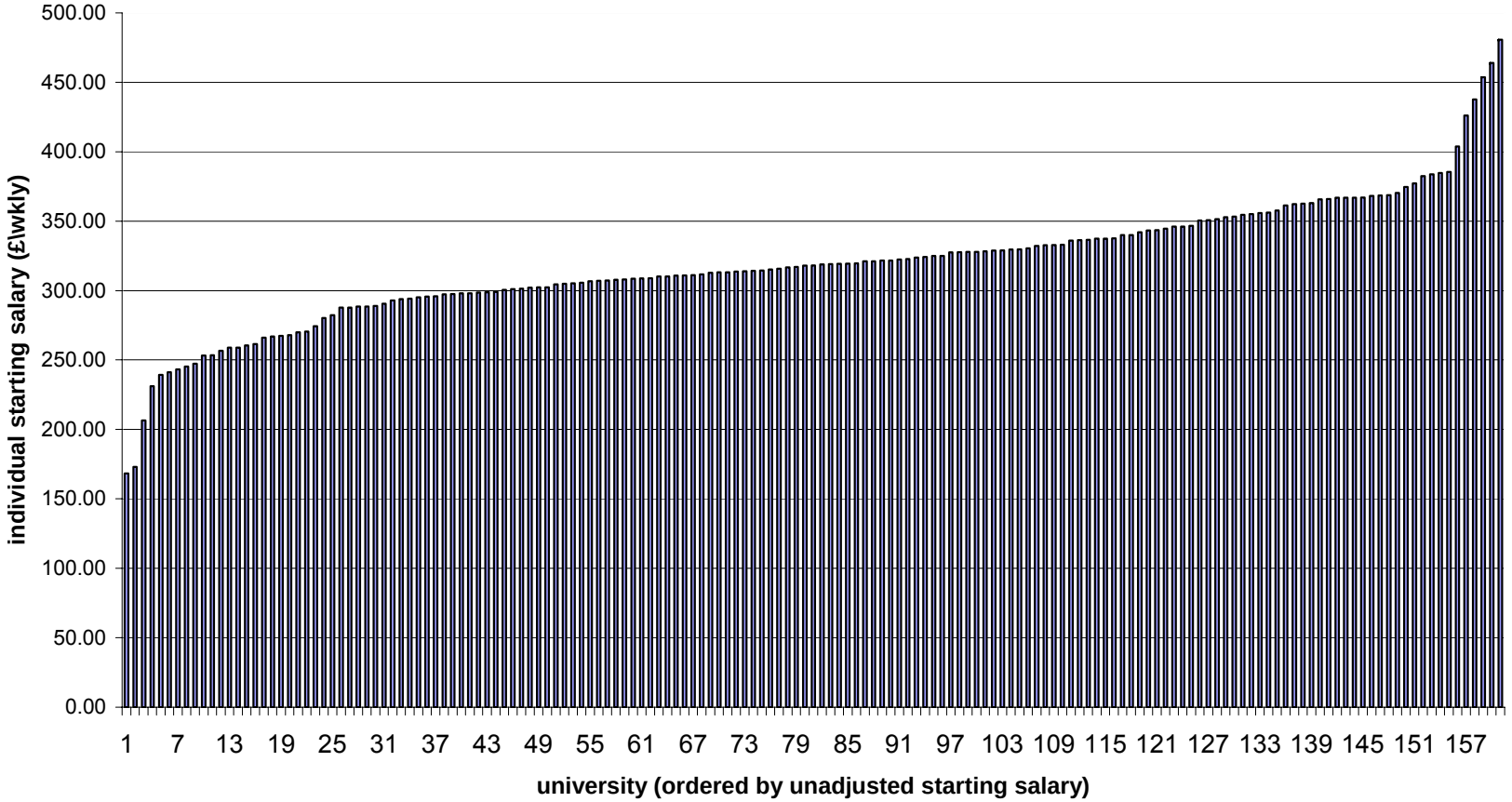


Figure 2: Average Earnings by Gender and HEI Type

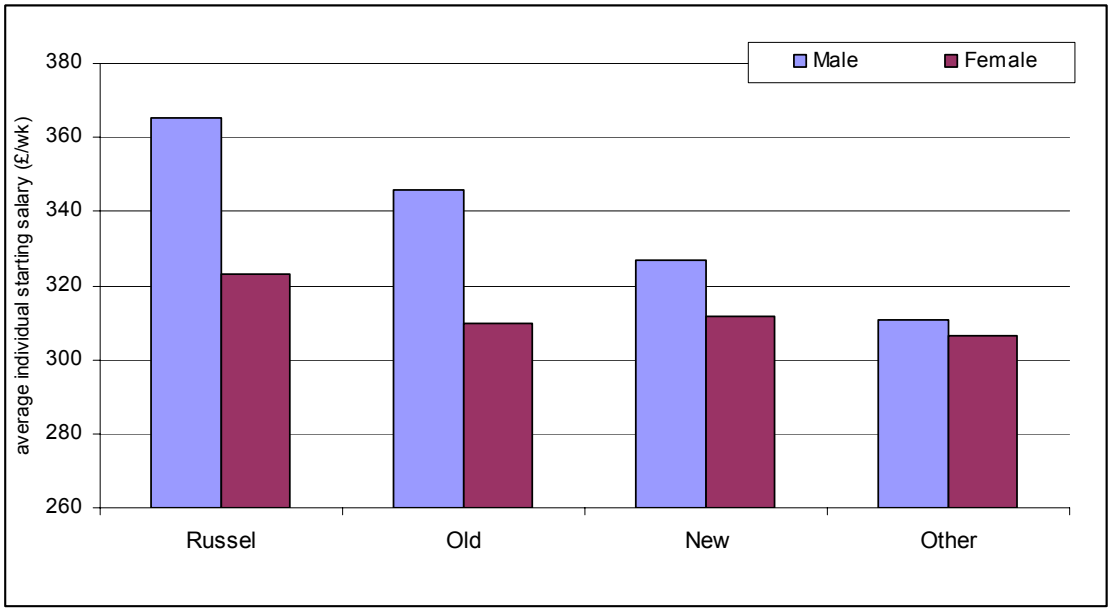


Figure 3: Average Earnings by Gender and Degree Classification

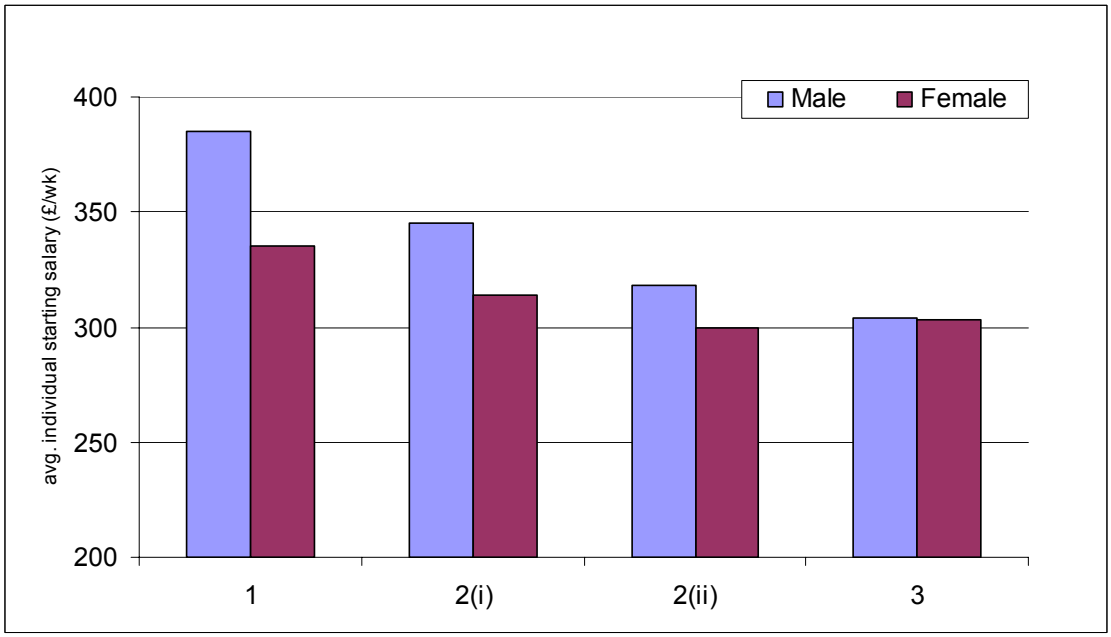
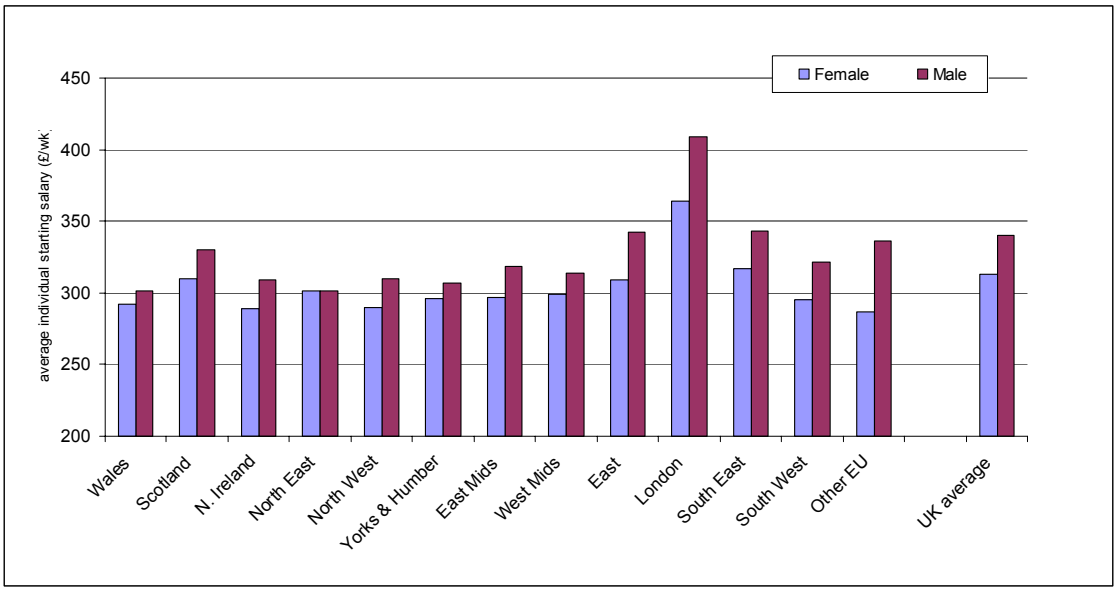


Figure 3 illustrates the effect of degree classification in the raw data, as we might expect there is a positive correlation between the level of achievement and earnings, such that, the starting salary for someone holding a First is on average 18% higher than someone holding a Third.[18] It is interesting to look at degree classification by university-type, Annex D refers. We have already noted the positive correlation between the more research-orientated, established universities, and earnings. There are two key features of Annex D; firstly, across all university-types male graduates outperform female graduates at both the top level of achievement and the lowest level of achievement. Secondly, 'Russell' graduates have the best achievement record with the highest (lowest) proportion of top (low) achievers, followed by 'old' then 'new' graduates.

Figure 4: Average Earnings by Gender and Region of Employment



[18] The correlation is significantly stronger (weaker) for men (women) at 26.8% (10.5%).

The regional distribution of graduate earnings is shown in Figure 4. There are two noteworthy points; firstly, average earnings are skewed to the right with London, the South East, South West and Eastern regions displaying the highest average graduate starting salaries. Average starting salaries are 29% higher in London (highest earnings region) compared to Northern Ireland (lowest earnings region). Secondly, average male starting salaries are higher than female starting salaries in each region of the UK. Evidently graduates working in Northern Ireland are amongst the lowest paid graduates in the UK. However, if we adjust the raw data to take account of the cost of living across regions we see that, whilst the broad trend remains the same, there is a significant narrowing of the regional earnings differential. Graduates working in Northern Ireland, Wales and many of the northern English regions exhibit relatively low average earnings but these regions also have a significantly lower cost-of-living compared to the UK average.[19]

[19] ONS produces two regional price series, one which excludes housing price differentials and the other which includes them. Both of these are presented in Appendix E. In the current analysis, earnings are 'rationalised' using the latter, that is, including housing costs.

Table 4: Cost-of-Living Adjusted Average Earnings by Region (£/wk)

	Average earnings	CoL adjusted avg. earnings
Wales	295	317
Scotland	316	335
N.Ireland	296	309
North East	301	320
North West	299	308
Yorkshire & Humber	301	319
East Midlands	305	313
West Midlands	305	312
East	323	319
London	383	349
South East	328	311
South West	306	302

Table 4 illustrates that there is a significant realignment of earnings when a regional cost-of-living index is applied. Regions with a higher cost-of-living measured relative to the UK average have adjusted average earnings below raw earnings, and vice versa. So, for example, the earnings advantage associated with working in London over Northern Ireland falls from 29% to 13%. Intuition suggests that, as well as a cost-of-living differential, varying occupational and industrial structure across regions could be a key driver of regional graduate earnings. This theory is backed up by, for example, Blackaby and Manning (1990) who examine nominal earnings in the UK and conclude that differences in the industrial and occupational base were the major determinant in the regional wage disparity between the South East of England and the rest of Great Britain.

In order to test this hypothesis we incorporate interaction variables within the ordinary least squares estimates presented in Section 3, all of which it should be noted were of no significance at standard levels of statistical inference. In the meantime however, Table 5 and Table 6 present the regional mix of jobs across occupation and industry respectively.

Pre-empting our discussion around occupational and industrial distribution and by way of background, we present in Annex F the distribution of graduates[20] across Government Office Regions. With reference to the regional distribution of the total workforce[21], the table allows us to draw an inference about the representation of graduates across and within regions. Thus, a ratio of the share of graduate employment to total workforce employment greater then unity implies an over-representation of graduates in the regional workforce. Similarly, a ratio less than 1 implies an under-representation, compared to what we might expect on the basis of the size of the regional labour market. Clearly evident from Annex F is the fact that there is a heavy clustering of graduate employment in London and the South East, where for example 20.4% and 12.9% of all male graduates are employed, respectively. In terms of graduate representation we can see that the ratio of graduate employment to total workforce employment is greatest in London, at 1.56 for all graduates. Interestingly, graduate over-representation is not found in the South East but rather two Northern regions of England, in particular the North East. At the other extreme is Northern Ireland,

[20] Graduates are defined in this instance, for the purpose of generating a more representative sample, those who possess a university degree and will include those whose highest educational qualification is either a first degree or a higher degree.

[21] As at 2005(Q4) – in order to keep alignment with graduate data based on DLHE 2004/05

which has 2.7% of the male workforce and yet only 2.2% of male graduates. For women in Northern Ireland, there is a much closer alignment with a ratio of 0.97. Tables 5(a) and 5(b), page 34 and page 35 respectively, represent the occupational composition of male and female graduates across regions. Tables 6(a) and 6(b) on page 36 do the same for industrial composition. Looking firstly at Table 5(a) we can see that the occupational distribution of male graduates between regions does not sit as neatly within a north/south divide representation as we might have expected. So, for example, Yorkshire and The Humber has the highest concentration of male graduates employed within "Managers and Senior Officials" occupations, similarly, Northern Ireland the highest proportion employed within "Professional" occupations. That said, taking the three highest earning occupations as a whole London emerges as the region with the highest representation (77%), the comparable figures in the North West and Wales are far lower at 64% and 63% respectively, with Northern Ireland at 73%. However, whilst London has the highest concentration of senior occupations (Table 5(a), rows 1-3) and highest average earnings (Table 5(a), row 7) it does not appear that it is this favourable occupational structure that explains the higher earnings. We note that Northern Ireland has the second highest concentration of graduates in senior occupations but observe that it has the fourth lowest average earnings. Put another way, compared to Northern Ireland there are seven regions with lower concentrations of graduates in senior occupations, which have higher average earnings than Northern Ireland. Similarly for female graduates the regional pattern of occupations is broadly in line with that observed for males

where, once again, Northern Ireland has the highest proportionate share of professional female graduates. Looking at the three highest average earning occupations as a whole, Scotland has the highest concentration of female graduates (72.8%) followed by London (68.2%) with Northern Ireland ranked fourth (67.3), behind the North East (67.8%). This compares favourably with the North West (61.1%) and the South West (60.8%). As before there appears to be no demonstrable influence of occupational structure over average female earnings.

In relation to industrial structure Tables 6(a) and 6(b) reflect the distinct pattern of industrial clustering across regions. In particular the regional over-representation of Banking, Finance and Insurance Services in London is evident. For men, Banking, Finance and Insurance Services accounts for approximately one in every two London-based graduate employees (48.9%). Whilst Public Sector jobs account for 16% of graduate employment in London this is still lower than the comparable proportion in any other region in the United Kingdom.

For women, the regional industrial distribution is broadly in line with that of men however, in this instance, the Public Sector is the dominant employer across every region, including London. That said, the proportion of Public Sector graduate employees in London (33.1%) is, by some margin, the lowest across all regions. On the other hand, Banking, Finance and Insurance Services continues to account for proportionately more graduate employees in London (32.5) than any other region, for example, Wales (14.2%) and Scotland (16.1).

Table 5(a)

Occupational Distribution (SOC2000) of Male Graduates by Region

	W	S	NI	NE	NW	YH	EM	WM	E	L	SE	SW
Managers and senior officials	8.1	8.8	9.2	9.5	11.4	12.4	11.9	11.1	10.9	11.1	12.1	11.5
Professional occupations	25.0	38.1	42.0	23.8	23.8	23.5	29.2	25.2	30.9	26.6	30.1	28.5
Associate professional and technical	29.9	25.4	22.2	32.8	29.0	31.1	29.3	29.3	30.7	38.8	29.5	28.4
Administrative and secretarial	17.3	8.6	13.3	14.2	16.2	15.5	11.2	14.5	11.2	12.2	11.3	14.4
Sales & Customer Services	11.0	9.3	7.3	12.2	11.0	9.4	8.2	10.4	8.4	6.2	6.7	6.8
Other occupations*	8.6	9.8	6.0	7.5	8.6	8.1	10.2	9.5	8.8	5.1	10.3	10.4
Mean weekly earnings (£)	301	330	309	301	309	307	318	314	342	409	343	321

* includes Skilled Trades, Process, Plant and Machine Operatives and Elementary Occupations

Table 5(b)

Occupational Distribution (SOC2000) of Female Graduates by Region

	W	S	NI	NE	NW	YH	EM	WM	E	L	SE	SW
Managers and senior officials	4.6	7.5	5.2	5.4	9.6	6.8	8.8	6.0	7.3	8.5	6.6	8.0
Professional occupations	12.1	19.4	24.1	15.9	13.7	17.9	18.4	15.0	19.4	17.7	19.0	13.4
Associate professional and technical	44.7	45.9	38.0	46.5	37.8	39.6	36.4	42.8	40.0	42.0	39.4	39.4
Administrative and secretarial	20.2	13.3	18.0	18.6	18.6	18.7	18.0	20.1	17.7	19.4	17.3	20.1
Sales & Customer Services	9.8	6.7	7.7	6.1	11.4	8.9	9.2	7.6	6.9	6.2	8.0	7.4
Other occupations*	8.5	7.2	7.0	7.5	9.0	8.1	9.2	8.5	8.6	6.2	9.2	11.7
Average gross earnings (£)	292	309	288	301	289	295	296	299	309	364	317	295

* includes Skilled Trades, Process, Plant and Machine Operatives and Elementary Occupations

Table 6(a): Industrial Distribution (SIC92) of Male Graduates by Region

	W	S	NI	NE	NW	YH	EM	WM	E	L	SE	SW
A-F: Agri/Energy/Manuf/Construction	20.7	25.1	27.7	18.4	15.9	16.5	21.5	18.0	18.7	9.2	14.1	18.5
G,H: Distribution, Hotels & Restaurants	15.3	13.7	12.7	12.2	16.8	15.4	15.2	17.4	17.5	10.3	15.8	12.7
I: Transport & Communications	4.1	3.2	1.6	6.1	6.0	3.8	4.2	4.1	6.0	4.4	6.7	3.7
J,K: Banking, Finance & Insurance	26.6	29.5	31.8	34.7	36.9	32.9	30.1	31.9	29.6	48.9	36.8	36.5
L-N: Public admin/Education & Health	28.2	21.0	21.7	23.6	18.8	23.2	23.2	22.9	21.3	16.1	20.6	21.7
O-Q: Other Services	5.0	7.6	4.5	5.0	5.7	6.8	5.8	5.8	7.0	11.2	6.1	6.8
Average gross earnings (£/wk)	301	330	309	301	309	307	318	314	342	409	343	321

Table 6(b): Industrial Distribution (SIC92) of Female Graduates by Region

	W	S	NI	NE	NW	YH	EM	WM	E	L	SE	SW
A-F: Agri/Energy/Manuf/Construction	8.1	7.3	6.5	8.8	7.8	7.1	10.8	8.4	11.2	8.7	11.1	9.4
G,H: Distribution, Hotels & Restaurants	12.6	11.6	12.9	9.8	15.9	12.1	16.4	12.8	13.5	13.3	12.5	12.5
I: Transport & Communications	2.4	2.2	1.7	2.0	3.2	2.8	3.4	3.1	2.8	2.7	3.5	1.9
J,K: Banking, Finance & Insurance	14.2	16.1	20.8	18.7	24.7	22.3	18.3	20.1	20.6	32.5	24.8	21.7
L-N: Public admin/Education & Health	56.9	59.0	55.0	56.8	43.2	51.0	46.6	51.5	47.4	33.1	43.6	48.2
O-Q: Other Services	5.7	3.9	3.1	4.0	5.2	4.7	4.5	4.0	4.5	9.6	4.4	6.3
Average gross earnings (£/wk)	292	309	288	301	289	295	296	299	309	364	317	295

3. Results

The results of estimating the log-linear earnings regressions for both male and females are presented in Table 7, page 55-59. Table 7 reports the OLS coefficients on the variables relating to personal, institutional and regional characteristics, respectively.

From Table 7a it can be seen that average male graduate earnings are increasing in the age at which the student graduates, for females', average earnings are increasing up to age 33 and not beyond. The estimated coefficient for overseas students' implies that graduate earnings are, on average, between 9% – 11.5% higher than the earnings of an otherwise identical home domiciled student. Given that the HESA data does not capture information on overseas students leaving the UK after graduation this finding is likely to be biased by the fact that those who stay do so upon commanding a relatively high salary. In effect by comparing the average overseas student with the average UK student we are not comparing like-for-like. The estimated coefficients on Socio-economic class show a clear pattern of the effects of social class on the earnings of female graduates. Compared to a female graduate from a social class 2 (intermediate occupation) background, an otherwise identical female graduate earns, on average:

- 2.3% less coming from a social class 3 (small employers and own-account workers) background; &
- 2.5% less coming from a social class 5 (routine occupation) background.

There is a small but insignificant positive effect associated with a social class 1 (managerial and professional occupation) background. Likewise there is no

significant difference between graduates from social class 4 (lower supervisory & technical occupations) and social class 2, and similarly, between social class 6 (never worked & long-term unemployed) and social class 2. Using the OLS estimated variance-covariance matrix from the male regression, we perform a Wald test of joint significance on the SEC variable, that is, we test the hypothesis:

(1) Sec1 = 0

(2) Sec2 = 0

(3) Sec3 = 0

(4) Sec4 = 0

(5) Sec5 = 0

where:

F(3, 6385) = 0.77

Prob > F = 0.5730

from which we cannot reject the hypothesis that Socio-economic class is a statistically insignificant explanatory variable in determining male graduate earnings. Thus, there is some evidence, at least for females, that those from higher social class backgrounds progress into relatively higher paying jobs after graduation, even if the variation is quite small. Whether or not this means that the rate of return to a first degree is higher for these graduates is impossible to determine; without data on a cohort of students who could have but chose not to progress to university we cannot reject the hypothesis that a similar social gradient exists in the non-graduate earnings profile. In terms of Ethnicity, the estimated coefficients imply that, compared to a black male graduate, otherwise

identical White, Asian and Mixed race male students earn 9.3%, 7.8% and 5.5% more, respectively. On the other hand, female Asian and Mixed race graduates earn less than the average Black female graduate, (-3.0%) and (-4.0%), respectively. As with males, white females earn more than their Black contemporaries, however, the variation is significantly smaller (2.9%). There is no significant difference between the average earnings of disabled and able bodied graduates. Surprisingly, there also appears to be no statistically significant influence of total tariff scores on graduate earnings within the sample. Tables 7b (page 56) and 7c (page 58) show the estimated coefficients for the key variables of heterogeneity described earlier: degree subject, degree classification, institution-type, region of employment, occupation and industrial structure. The reference dummies are outlined in the notes to Table 7c. The estimated coefficients imply that:

Degree subject – Compared to the average earnings of a Social Studies graduate:

- an otherwise identical female (male) graduate with a *Medical related* degree earns, on average, 6.1% more (1.3% less)
- an otherwise identical female (male) graduate with a *Biological Sciences* degree earns, on average, 7.1% less (8.8% less)
- an otherwise identical female (male) graduate with an *Agricultural Related* degree earns, on average, 7.7% less (9.0% less)
- an otherwise identical female (male) graduate with a *Physical Sciences* degree earns, on average, 7.8% less (6.7% less)

- an otherwise identical female (male) graduate with a *Mathematical Sciences* degree earns, on average, 5.5% more
- an otherwise identical female (male) graduate with an *Engineering and Technology* related degree earns, on average, 8.4% less
- an otherwise identical female (male) graduate with an *Architecture related* degree earns, on average, 11.1% less (4.4% less)
- an otherwise identical female (male) graduate with a *Law* degree earns, on average, 2.2% less (4.4% less)
- an otherwise identical female (male) graduate with a *Mass Communication and Documentation* related degree earns, on average 7.1% less (10.1% less)
- an otherwise identical female (male) graduate with a *Languages* degree earns, on average, 7.3% less (13% less)
- an otherwise identical female (male) graduate with a *History and/or Philosophy related* degree earns, on average, 5.7% less (10.1% less)
- an otherwise identical female (male) graduate with a *Creative Arts and Design* degree earns, on average, 14.2% less (15.9% less)
- an otherwise identical female (male) graduate with an *Education related* degree earns, on average, 5.8% more

For both males and females there is no significant difference in graduate earnings between the reference group and Computer Science graduates. Similarly for Business and Administrative graduates. Using the estimated coefficients from the OLS regression we calculate adjusted graduate earnings for

each subject. Comparison of the adjusted earnings distribution with that in the raw earnings distribution reveals that the ranking of degree subject groups by graduate earnings changes very little after adjustment: the rank correlation coefficient is 0.8 (0.9) for females (males). That said there is a significantly lower standard deviation in the adjusted distribution compared to that in the unadjusted distribution.[22]

Degree classification - Compared to the average earnings of a male student graduating with an upper second class degree:

- An otherwise identical male student graduating with a *First class* degree earns, on average, 4.0% more
- An otherwise identical male student graduating with a *lower second class* degree earns, on average, 1.8% less
- An otherwise identical male student graduating with a *Third class* degree earns, on average, 4.2% less

Thus, for males, there is variation in average earnings of around 8% between the earnings associated with a first and those associated with a third class degree, for the otherwise average male graduate. For females the variation appears to be much less - at around 3% - however, as Table 7b shows, the estimated coefficients imply a counterintuitive relationship whereby students graduating with a third earn, on average, marginally more than the benchmark case of an upper second graduate. This finding would tend to sit counter to the argument forwarded by some commentators, which suggests that females outperform

[22] Female (male) standard deviation in earnings across subjects falls from 27.2 to 18.4 (31.8 to 18.3).

males at university because the marginal returns to degree performance are higher for females. A Wald test of joint significance suggests that degree classification is only weakly significant within the female earnings equation. So, for males at least, the estimated coefficients imply that the variation in earnings over degree class outcomes is large and significant. Given that degree classification is an *ex ante* outcome we can reasonably conclude that there must be considerable risk and uncertainty around the expected returns to a first undergraduate degree, particularly for males. If we look specifically at what could subjectively be termed 'good' degrees, that is, upper second class and above we see that on average males (females) graduating with a 'good' degree earn 3.1% (1.9%) more than someone graduating with a 'bad' degree, ceteris paribus. Reinforcing our view that degree classification is a key determinant of graduate earnings in the UK.

Institution-type – The statistically significant coefficients imply that compared to the average earnings of a graduate from a post-1992 'modern' university:

- an otherwise identical female graduate from an *'old'* university earns, on average, 3.4% less
- an otherwise identical male graduate from a *Russell Group* university earns, on average, 3.5% more

The effect that university attended has over future graduate earnings is of particular interest. Figure 2 illustrates that, in the raw data, there is a clear earnings premium in favour of Russell Group graduates; 4% and 13.3% for

female and male graduates, respectively.[23] By way of reminder, the Russell Group of universities represents a self-selected informal coalition of 20 research led institutions who sit within the 'old' university sector, and are generally considered to encompass the oldest and most prestigious higher education institutions within the UK. Such prominent institutions have argued that higher average earnings achieved by their graduates stems from the high quality teaching provided. The costly nature of such teaching has led these institutions to successfully lobby government for the right to charge higher tuition fees. In 2004-05 the government introduced legislation over and above the tuition fee reforms set out in the White Paper on Higher Education (HMO 2003), which seen the introduction of variable top-up fees in the UK in autumn 2006.[24] Government therefore seem to have accepted the argument of heterogeneity in the returns to higher education by institution-type. However, as was pointed out earlier, there is a dearth of UK literature on the effects of institution-type on earnings; the claim that Russell Group institutions provide higher financial returns to their graduates has not been clearly illustrated to date. Again, to illustrate and reinforce the point, we return to the distinction between observations from raw data and estimates from regression coefficients. In particular, a simple comparison of earnings data based on the former, as described in Section 2.2, can be misleading. Simply to compare the earnings of prestigious versus modern graduates is to ignore a number of important selection issues. The main difficulty

[23] Compared to 'modern' university graduates of the same cohort.
[24] Every higher education institution in the UK has the right to charge additional fees to undergraduates differentiated by subject and up to a maximum cap of £3,000 per annum - provided they meet specific requirements on widening participation for those individuals from 'non-traditional' university backgrounds.

is due to the heterogeneity of the student population attending higher education institutions; more prestigious universities are likely to attract, on average, students of higher academic ability and with different social backgrounds than students applying to and attending modern universities. In fact, the data show that, in relation to the former, Russell-university graduates hold on average 374 tariff points compared to 188 tariff points for 'modern' university graduates. Moreover, 20.4% of Russell-university graduates come from 'Managerial and Professional' social backgrounds compared to only 12.9% of 'modern' university graduates. By contrast, some 19.2% of 'modern' graduates come from 'Routein' social backgrounds compared to 10.6 of Russell graduates. There is also likely to be a historically diverse make-up of course provision between the two, reflected in the academic versus vocational nature of institutional course provision. Thus, in light of these issues, it is crucial that where possible we account for pre-university personal and academic characteristics through regression techniques, such as the OLS method employed here. We can see from the regression coefficients reported in Table 7b below and reflected above that, at least for males, the premium enjoyed by Russell Group graduates over 'modern' graduates is significantly reduced, by around 10%, from 13.3% to 3.5%. Thus, after controlling for the heterogeneity of students, we find limited evidence that graduate earnings vary to any significant extent by the type of institution attended. In these circumstances it is difficult to justify variable top-up fees by institution.

Region of employment - Compared to the average earnings of a female (male) graduate employed in the South East of England:

- an otherwise identical female (male) graduate employed in the *North East* of England earns, on average, 10.4% less (15.4% less)
- an otherwise identical female (male) graduate employed in the *North West* of England earns, on average, 8.9% less (9.7% less)
- an otherwise identical female (male) graduate employed in the *Yorkshire & Humber* region of England earns, on average, 9.3% less (10.3% less)
- an otherwise identical female (male) graduate employed in the *East* of England earns, on average, 7.2% less (9.0% less)
- an otherwise identical female (male) graduate employed in the *West Midlands* earns, on average, 8.3% less (9.0% less)
- an otherwise identical female (male) graduate employed in the *East Midlands* earns, on average, 2.1% less (2.3% less)
- an otherwise identical female (male) graduate employed in *London* earns, on average, 16.0% more (16.0% more)
- an otherwise identical female (male) graduate employed in the *South West* of England earns, on average, 8.0% less (7.6% less)
- an otherwise identical female (male) graduate employed in *Scotland* earns, on average, 7.4% less (4.7% less)
- an otherwise identical female (male) graduate employed in *Wales* earns, on average, 7.9% less (10.5% less)

- an otherwise identical female (male) graduate employed in *Northern Ireland* earns, on average, 13.8% less (9.3% less)

To investigate the regional aspect further we introduce firstly, a 'North-South' divide whereby, of the 11 standard regions conventionally distinguished in the UK, the East Midlands, East of England, South East (inc. Greater London) and the South West constitute the 'South' and the West Midlands, Yorkshire and Humberside, Northern Ireland, North West, North East, Wales and Scotland constitute the 'North'. This division follows the well-known line running from the Severn to the Wash. In addition to the standard 'North-South' divide we also consider a 'regional' divide with the standard regions grouped into four broadly defined regions; the Periphery (Northern Ireland, Wales, Scotland and the North East of England), the Centre (West Midlands, East Midlands, Yorkshire and Humberside and the North West) the South excluding Greater London (South West, South East and East of England) and Greater London. We then repeat the log-linear earnings regression as before, controlling for other personal, academic and institutional characteristics. The estimated coefficients are as follows:

‘North-South' Divide	FEMALE	MALE
	Coefficient	Coefficient
North	-0.109***	-0.122***
	(-18.03)	(-14.79)

‘Regional' Divide	FEMALE	MALE
	Coefficient	Coefficient
Periphery	0.052**	-0.014
	(1.99)	(0.36)
Central	0.054**	0.000
	(2.15)	(0.01)
South excl. Gr London	0.111***	0.067*
	(4.37)	(1.75)
Greater London	0.298***	0.256***
	(11.58)	(6.57)

Notes

Residual category for ‘North-South’ is South

Residual category for ‘Regional’ is Northern Ireland

The coefficients clearly imply that there is a systematic regional bias in graduate earnings. In relation to the ‘North-South’ divide the coefficients suggest that graduates employed in the ‘North’ earn on average 11.5% less than graduates based in the ‘South’, ceteris paribus. Looking then at the ‘Regional’ divide we see that for females in particular there is a strong effect, but more generally that there is significant imbalance between the average earnings of Northern Ireland based graduates and graduates based in the prosperous South East of England. Compared to the average earnings of a female (male) graduate employed in Northern Ireland:

- an otherwise identical female (male) graduate employed in the South East of England exl. Greater London earns, on average 11.1% more (6.7% more)
- an otherwise identical female (male) graduate employed in Greater London earns, on average 29.8% more (25.6% more)

Occupation - Compared to the average earnings of a female (male) graduate employed in a Skilled Trade occupation:

- an otherwise identical female (male) graduate employed in a managerial/senior official occupation earns, on average, 18.0% more (20.9% more)
- an otherwise identical female (male) graduate employed in a professional/associate professional or technical occupation earns, on average, 14.7% more (13.6% more)
- an otherwise identical female (male) graduate employed in an administrative or secretarial occupation earns, on average, 1.1% less (5.0% less). However, the difference is not statistically significant for men or women.
- an otherwise identical female (male) graduate employed in a service occupation earns, on average, 12.9% less (14.9% less)
- an otherwise identical female (male) graduate employed in an elementary occupation earns, on average, 20.8% less (21.2% less)

More generally we observe, as a result of estimating the log-earnings equation in terms of Occupational status, that graduates employed within 'high' status occupations[25] in the UK earn, on average, 23.6% more than their erstwhile classmates employed, for example, within Skilled Trades, Sales and other Elementary occupations, ceteris paribus. Furthermore, the financial reward to obtaining 'high' status employment is, on average, greatest in Scotland and Yorkshire & Humber and lowest in Northern Ireland. In the case of the former regions, graduates employed in 'high' status occupations can expect to earn, on average 27% more. In Northern Ireland the financial reward is significantly less at 16%. These results are statistically significant with 99 per cent confidence.

Industry – Compared to the average earnings of a female (male) graduate employed within the Banking, Finance and Insurance industries:

- an otherwise identical female (male) graduate employed within *Distribution, Hotels and Restaurants* industries earn, on average, 11.8% less (15.2% less)
- an otherwise identical female (male) graduate employed within *Public Administration/Education and Health* industries earns, on average, 1.5% less (5.1% less)

[25] High status occupations include 'Managers and Senior Officials', 'Professionals' and 'Associate Professional and Technical'

- an otherwise identical female (male) graduate employed within *'Other' Service* industries earns, on average, 12.8% less (13.6% less)

Gender – compared to an otherwise identical female graduate, male graduates earn on average 3.8% more. In the raw data the advantage was 8.4% so whilst the earnings differential has narrowed significantly – by more than half – there clearly remains a systematic gender bias in graduate earnings in the UK.

In sum, these results suggest that there is substantial variation around the average earnings of graduates according to degree subject, region of employment, occupation and industry, *inter alia*. We find variation by degree classification but not substantially so, certainly not for females at least. We find evidence of financial reward, albeit it relatively small, to obtaining a 'good' degree. We contend, therefore, that estimates of the average rate of return to a university degree, as cited in the governments White Paper on higher education for example, are likely to conceal much variation about the average. However, we also find that variation by institution-type has only a relatively weak effect on graduate earnings. The view that graduate earnings vary considerably according to the university attended has been central to informing the move away from flat tuition fees to variable or 'top-up' fees in the UK. The evidence of the magnitude of variation in earnings by institution presented in this paper is not entirely consistent with that position. From a sample of 17,298 UK graduates we find that institution attended, whilst a statistically significant determinant of earnings,

accounts for only a small proportion of earnings variability. More generally, we note that our gender-specific regression models explain only a relatively small proportion of the variance in graduate earnings: the Adjusted R^2 is 32% for the female equation and 35% for the male equation.

For students the decision of whether or not to participate in higher education represents now more than ever a financial investment decision. Under such circumstances it is favourable to have complete information. Degree classification is clearly an area of uncertainty for students, one which cannot accurately be pre-determined but which will affect earnings potential. It is interesting therefore to examine how this area of uncertainty regarding earnings varies across university and by degree subjects, both of which are within students' control. In order to investigate this we identify a subset of universities, and degree subjects, associated with 'high earnings' and 'low earnings'. The selection of each subset is made on the basis of the OLS adjusted earnings obtained from the regression results, as reported above. Then, having distinguished between a subset of 'high earning' universities and a subset of 'low earning' universities, we regress earnings against degree classification separately for each subset. Similarly, we regress earnings against degree classification separately for each degree subject subset – 'high earnings' and 'low earnings'. The results are presented in Table 8.

From Table 8 we can see that, for female students, there is a 5.7% earnings premium associated with a first class degree over and above an upper second at 'high earnings' universities, compared to 6.1% at universities with low average

earnings, *ceteris paribus*. Similarly, there is a slightly higher earnings premium for a first over an upper second for male graduates from 'low earnings' universities compared to males from 'high earnings' universities. The p-values show, however, that these differences between subsets of university are statistically insignificant. From Table 8 we can also see that the earnings premium associated with a first over and above a third class degree is greater at 'high earnings' universities. Moreover, this difference is statistically

Table 8: Regression results for earning equations for separate sets of university and degree subject groups: Dependent variable is log of earnings

	FEMALES				MALES			
	R2	1st - 2:1	2:1 - 2:2	2:2 - 3rd	R2	1st - 2:1	2:1 - 2:2	2:2 - 3rd
University								
High earning	0.005	5.7	3.9	-1.1	0.023	9.0	6.5	8.3
Low earning	0.007	6.1	2.0	0.3	0.019	10.8	2.8	5.9
p-values		0.802	0.082	0.086		0.804	0.001	0.002
Degree subjects								
High earning	0.016	10.8	4.6	1.0	0.059	18.7	8.9	7.1
Low earning	0.005	4.1	3.9	0.6	0.007	10.3	2.7	8.8
p-values		0.100	0.031	0.069		0.592	0.699	0.018

significant. For example, by summing across columns we can see that the earnings premium associated with a first over a third is 23.8% (19.5%) for males graduating from 'high earnings' ('low earnings') universities. The p-value implies that the difference across universities is statistically significant at the 1% level. For females, the earnings reward associated with a first class over a third class

degree is broadly similar across both 'high earnings' (8.5%) and 'low earnings' (8.4%) universities, however, the p-value shows that the marginal difference is statistically significant at the 10% level. With regards to differences across degree subject in the earnings premium associated with particular degree classes, Table 8 shows that the additional earnings associated with a first class degree over a third class degree is greater for those subject groups associated with relatively high earnings. For females, the earnings premium associated with obtaining a first class over a third class is 16.4% in 'high earnings' subjects, compared to 8.6% in 'low earnings' subjects. For males, the earnings premium associated with obtaining a first class over a third class is 34.7% in 'high earnings' subjects, compared to 21.8% in 'low earnings' subjects. The difference across the two sets of subjects is significant at 10% for women and at 5% for men.

So what if any conclusion can we draw from this analysis? Well, there would appear to be evidence, as presented in Table 8, that the element of risk and uncertainty involved in higher education investment is greater at those universities and for those degree subjects most associated with relatively high graduate earnings. In a variable fee environment these are the very universities and courses most likely to be subject to 'top-up' fees. The corollary of this finding leads us to be somewhat concerned that the introduction of variable tuition fees, from September 2006, may be having a potentially strong disincentive effect on the participation of students from poorer family backgrounds. If it is only better off students who can afford to finance the cost of relatively risky investments in

those university courses associated with relatively high earnings, then there is likely to be an adverse impact on equality of opportunity and intergenerational mobility over time. This concern is not without reason, in fact there is broader evidence to support the view that the risk and uncertainty associated with higher education investment is greatest for those students from less well off family backgrounds. For example, based on a sample of University of Ulster students, Borooah and Bailey (2007) show that the probability of dropping-out of higher education, that is, failing to proceed to the second year of study, is higher for students from an unskilled background as compared to those from a professional social class. Smith and Naylor (2000b) find that there is a greater probability of academic failure for such students. Further, from our dataset we note that the standard deviation in degree classification for students from low socio-economic family backgrounds[26] is 1.70, compared to 1.46 for all students, indicating greater unconditional variation in degree class for students from poorer family backgrounds.

[26] That is, SEC categories 4, 5, 6, 7 and 8.

Table 7a: Regression results for OLS earnings equations: Personal Characteristics

Variable	FEMALE Coefficient	MALE Coefficient
Age 24 - 27	0.076***	0.073***
	(5.7)	(4.5)
Age 28 - 33	0.120***	0.130***
	(6.77)	(5.23)
Age 34 +	0.097***	0.197***
	(6.7)	(7.8)
Overseas student	0.114***	0.092**
	(3.19)	(1.96)
SEC 1	0.001	0.018*
	(0.15)	(1.65)
SEC 3	-0.023*	0.003
	(1.86)	(0.17)
SEC 4	-0.016	0.019
	(1.15)	(0.99)
SEC 5	-0.025**	0.005
	(2.52)	(0.39)
SEC 6	-0.087	0.033
	(0.79)	(0.15)
White	0.029	0.093***
	(1.32)	(2.79)
Asian	-0.03	0.078**
	(1.21)	(2.17)
Mixed	-0.04	0.055
	(1.3)	(1.22)
Disability	0.004	-0.018
	(0.37)	(1.17)
Total tariff Score	0.001	-0.002
	(0.45)	(0.49)

Table 7b: Regression results for OLS earnings equations: Institutional Characteristics

Variable	FEMALE Coefficient	MALE Coefficient
Medical Related	0.061***	-0.013
	(5.17)	(0.56)
Biological Sciences	-0.071***	-0.088***
	(6.50)	(5.41)
Agriculture and Related Subjects	-0.077***	-0.09**
	(2.96)	(1.99)
Physical Sciences	-0.078***	-0.067***
	(4.72)	(3.56)
Mathematical Sciences	0.055*	-0.001
	(1.89)	(0.05)
Computer Science	-0.023	-0.005
	(0.89)	(0.30)
Engineering and Technology	-0.084**	0.008
	(2.32)	(0.4)
architecture, building & planning	-0.111***	-0.044*
	(3.22)	(1.70)
Law	-0.022	-0.044*
	(1.26)	(-1.73)
Business & administrative studies	0.002	-0.007
	(0.17)	(0.47)
Mass communication & documentation	-0.071***	-0.101***
	(4.73)	(4.58)
languages	-0.073***	-0.13***
	(-5.42)	(5.28)
Historical & philosophical studies	-0.057***	-0.101***
	(3.93)	(5.64)
creative arts & design	-0.142***	-0.159***
	(11.75)	(9.30)

Table 7b: Cont'd

Variable	FEMALE Coefficient	MALE Coefficient
Education	0.058***	0.004
	(3.88)	(0.10)
Combined	-0.103***	-0.115**
	(2.81)	(2.12)
First	0.011	0.04***
	(1.19)	(3.03)
Lower Second	-0.019***	-0.018**
	(2.79)	(2.03)
Third	0.001	-0.042**
	(0.06)	(2.15)
Other Class	0.002	-0.104***
	(0.1)	(4.00)
Good Degree	0.019***	0.031***
	(2.93)	(3.74)
Old	-0.034***	0.002
	(4.39)	(0.24)
Russell	-0.002	0.035***
	(0.26)	(2.93)
Other HEI	-0.032**	-0.008
	(2.30)	(0.36)

Table 7c: Regression results for OLS earnings equations

Variable	FEMALE Coefficient	MALE Coefficient
Scotland	-0.074***	-0.047
	(3.34)	(1.61)
Wales	-0.079***	-0.105***
	(5.26)	(4.91)
N.Ireland	-0.138***	-0.093**
	(5.35)	(2.37)
North East	-0.104***	-0.154***
	(6.23)	(6.76)
North West	-0.089***	-0.097***
	(7.74)	(6.31)
Yorkshire & Humber	-0.093***	-0.103***
	(8.04)	(6.63)
East	-0.072*	-0.09*
	(1.67)	(1.66)
West Midlands	-0.083***	-0.09***
	(6.88)	(5.20)
East Midlands	-0.021***	-0.023***
	(5.92)	(5.30)
London	0.16***	0.16***
	(15.8)	(11.66)
South West	-0.08***	-0.076***
	(6.56)	(4.56)
Other	-0.284***	-0.241***
	(10.71)	(7.80)
Managers	0.18***	0.209***
	(3.93)	(6.67)
Prof, Associate Prof & Technical	0.147***	0.136***
	(3.29)	(4.57)

Table 7c: Cont'd

Variable	FEMALE Coefficient	MALE Coefficient
Admin & Secretarial	-0.011	-0.05
	(0.25)	(1.61)
Service Occupations	-0.129***	-0.149***
	(2.86)	(4.82)
Elementary Occupations	-0.208***	-0.212***
	(4.30)	(6.41)
High Status Occupations	0.219***	0.255***
	(35.40)	(29.61)
Agri/Energy/Manuf/Construction	0.007	0.018
	(0.59)	(1.42)
Distribution, Hotels & Restaurants	-0.118***	-0.152***
	(11.59)	(11.71)
Transport & Communications	-0.003	-0.006***
	(0.16)	(0.32)
Public admin/Education & Health	-0.015**	-0.051***
	(1.96)	(4.52)
Other Services	-0.128***	-0.136***
	(10.23)	(9.08)

Notes:

Residual category for *Age* is "Age<24"

Residual category for *Socio-Economic Class* is Intermediate Occupations

Residual category for *Ethnicity* is Black

Residual category for *Degree Subject Area* is Social Studies

Residual Category for *Degree Classification* is Upper Second

Residual category for *University-Type* is "New"

Residual category for *Region of Employment* is South East

Residual category for *Occupation* is Skilled Trade.

Residual category for *'High' Status* is low status occupations, which includes Admin & Secretarial, Service and Elementary occupations.

Residual category for *Industry* is Banking, Finance & Insurance Services

Total Tariff Score

Absolute value of t statistics in parentheses

* significance at 10%; ** significance at 5%; *** significance at 1%

4. Analysis by Inequality Decomposition

This section, using the HESA micro-data for the 2004/05 graduate cohort, examines the issue of graduate income inequality in the United Kingdom. The analysis of inequality is often illustrated with the analogy of an economic cake, and specifically the distribution of that cake among the members of a given population. Indeed the concept of inequality runs much broader than on a purely income-specific basis, frequently in life we observe inequality of outcomes between persons, whether they be social, political or economic outcomes. As social scientists we are inherently attracted to study these unequal outcomes, the first stage of which is generally to construct summary measures to reflect the extent of inequality. Annex G [Table 1], presents some of the key inequality indices in relation to UK graduate income for the North-South and the regional divide. Continuing the theme of heterogeneity developed earlier Annex G [Tables 2 – 5] presents a similar set of statistics for subject, occupation, industry and institution, respectively.

Table 1 shows that levels of mean gross weekly graduate income in the south, at £328, were 15% higher than the corresponding level of £287 in the North. The North, with 42% of all UK graduates, received only 38% of UK graduate income. At the regional level, the prosperous Greater London region with 20% of graduates in the sample, received almost one quarter of total graduate income and enjoyed a mean gross weakly per capita income that was 22% above the UK average; conversely, the poorer peripheral region of the UK, with 12% of graduates, received 11% of total graduate income and had a mean per capita

income that was 92% of the UK average. The Gini coefficient is perhaps the most commonly used tool for measuring the extent of income inequality and is defined as:

$$G(y;N) = \sum_i \sum_j \frac{|y_i - y_j|}{2N^2\mu}$$

$$where \quad \mu = \frac{\sum_i y_i}{N} \; and \quad |\ \ | \; represents \quad absolute \quad value$$

The coefficient takes values between 0 and 1. If income is distributed perfectly equally amongst a population, then the value of the Gini coefficient will be 0. If income is distributed as unequally as possible – that is, if a single graduate receives all graduate income in the country – then the Gini coefficient will be 1. On this basis then we see that graduate income inequality in the North (G=0.15) was slightly lower than in the South (0.17), though evidently the values were not markedly different. So, whilst average graduate earnings were greater in the South of the UK, they were also more unequally distributed.

The study of income inequality is particularly concerned with investigating the extent to which inequality in the total population can be attributed to income differences between major population subgroups. In other words, how much of the overall income inequality that we observe in graduate income can be explained by inequality within groups and how much can be explained by inequality between groups? So, for example, it would be interesting to know how

much of the overall inequality in the distribution of UK graduate income can be explained by inequality in the distribution within subjects and how much can be explained by inequality between subjects. Fortunately, thanks to the pioneering work of Theil, Shorrocks and Cowell, amongst others, we have the necessary knowledge to answer such questions. Using 'inequality decomposition' techniques we can, using the population subgroups identified in Section 1, decompose overall inequality in graduate earnings. Suppose that the sample of *N* graduates is divided into *M* mutually exclusive and collectively exhaustive groups with N_m (m = 1,…, M) graduates in each group. Let $\mathbf{y} = \{y_i\}$ and $\mathbf{y}_m = \{y_i\}$ represent the vector of incomes for, respectively, all the graduates in sample (I = 1,…, N) and all the graduates in group m. Then an inequality index $I(\mathbf{y}; N)$ defined over this vector is said to be additively decomposable if:

$$I(y;N) = \sum_{m=1}^{M} I(y_m; N_m) w_m + B = A + B \qquad (1)$$

where $I(\mathbf{y}; N)$ represents the overall level of inequality; $I(y_m; N_m)$ the level of inequality within group m; **A** - expressed as the weighted sum of the inequality in each group, w_m being the weights – and **B** represent, respectively, the *within-group* and the *between-group* contribution to overall inequality. Shorrocks (1980) showed that only inequality indices which belong to the Generalised Entropy (GE) family of indices are additively decomposable. These indices are defined by a parameter θ; when θ = 0, the weights are the population shares, and when θ = 1 the weights are the income shares, of the subgroups. When θ = 1 the inequality index is defined as Theil's Entropy index, denoted T(y;N) as:

$$GE(1) = T(y;N) = \frac{\sum_{i=1}^{N}(y_i/\mu)\log(y_i/\mu)}{N} \quad (2)$$

and when θ = 0, the inequality index is defined as Theil's Mean Logarithmic Deviation index, denoted MLD(y;N), as:

$$GE(0) = MLD(y;N) = \frac{\sum_{i=1}^{N}\log(\mu/y_i)}{N} \quad (3)$$

Then as Cowell and Jenkins (1995) have shown, assuming that Eq. (1) above allows us to 'additively decompose' inequality, we can interpret the proportionate contribution of the between-group component (**B**) as the analogue of the R^2 statistic used in regression analysis: the size of the between-group contribution is a measure of the amount of inequality that can be 'explained' by the factors used to partition the sample. Against this background, we can now summarise the empirical results. Table 9 shows the results from decomposing graduate income inequality by subdividing the sample of 15,666[27] graduates along one of the following lines:

I. Region
II. Subject
III. Occupation
IV. Industry
V. Institution

using the MLD index, as defined above in Eq. (3).

[27] We drop graduates in part-time paid employment as well as those in full-time paid employment outside of the UK, which reduces the sample from 17,298 to 15,666.

Table 9: Percentage Within- and Between-Group Contributions to Inequality: Mean Logarithmic Index

Decomposition By ↓	Contribution (%)
Region	
Within-Group Contribution	95.6
Between-Group Contribution	4.4
Total	100
Subject	
Within-Group Contribution	91.7
Between-Group Contribution	8.3
Total	100
Occupation	
Within-Group Contribution	78.8
Between-Group Contribution	21.2
Total	100
Industry	
Within-Group Contribution	94.8
Between-Group Contribution	5.2
Total	100
Institution	
Within-Group Contribution	89.0
Between-Group Contribution	11.0
Total	100

There are a couple of noteworthy points. Firstly, the level of inequality associated with the distribution of income, across the 15,666 graduates, was actually quite low. The values of the MLD index and of the Gini coefficient were

0.04797 and 0.16529, respectively. Secondly, only 4.4% of overall graduate inequality in the UK could be 'explained' by differences in the mean income between regions. On the other hand, occupation provided the best explanation for the observed inequality in the distribution of graduate income: slightly more than one fifth (21.2%) of the inequality in incomes between graduates could be 'explained' by differences in the mean income between occupations. Institution provided a reasonable explanation for the observed inequality with 11% of inequality 'explained' by differences in the mean income between graduates of different institutions. However, the general conclusion must be that, for all five types of disaggregation, and for both the Entropy and MLD indices[28], the substantial part of overall inequality is the result of within-group inequality and only a very small part is due to between group inequality. Thus, for example, on the MLD index, for the UK as a whole, when the subgroups were defined by the degree subject, 92% of inequality was the result of within-group inequality; for disaggregation by Industry it was 95% and by region it was 96%.

[28] See Annex G [Tables 2 – 5].

5. Deprivation Analysis

Where Section 4 applied the methodology of inequality decomposition to graduate earnings we now bring the analysis to a natural conclusion by investigating the source and extent of deprivation in UK graduate earnings. In this instance of course it is 'relative' as opposed to 'absolute' deprivation we examine. Dealing with inequality and poverty separately is convenient for the purpose of analysis however; it should not obscure the fact that the two are intimately related. In particular, following Sen's (1976) contribution, the unequal distribution of income among the poor is now generally regarded by economists as contributing to the level of poverty in a society; conversely both inequalities in the distribution of income among the poor and the fact that there exist, in a given society, both poor and non-poor persons contributes to overall inequality. So, with this in mind we continue with an application to graduate income.

Typically in economics it is appropriate to identify a level of 'poverty line' income, say z, and to regard all persons (or households) as being 'poor' if income is equal to or below this threshold. Given the poverty line z and the distribution of incomes - represented by the vector y - a poverty measure or index is a real valued function P(y;z), which indicates the level of poverty associated with y and z. From this methodology we derive a number of aggregate measures of poverty. In order to investigate these further lets assume that we have a population of N individuals, with incomes y_i, $i = 1,\ldots, N$ arranged in ascending order, where M individuals have incomes equal to or less than the poverty line, z.

Then two of the most common measures of poverty are the Head Count Ratio (H) and the Poverty Gap Ratio (R) defined as:

$$H(y;z) = \frac{M}{N} \tag{4}$$

and

$$R(y;z) = \frac{\sum_{i=1}^{M}(z - y_i)}{Mz} = 1 - \frac{\mu^p}{z} \tag{5}$$

respectively. Where μ^P is the mean income of the poor; H is the proportion of the population who are poor and R is the mean income shortfall of the poor expressed as a proportion of the poverty line. In 1976 Sen proposed a further more comprehensive measure of poverty, which introduced the concept of relative deprivation:

$$S(y;z) = H[R + (1-R)G^p\ ]$$

(6)

by computing income inequality over the incomes of poor individuals, G^P. The Sen index is an increasing function of H, R and G and lies in the closed interval [0, 1], the limits being defined when all individuals have zero income and, at the other extreme, there are no poor. Finally, Thon (1979, 1983) offers a further aggregate measure of deprivation[29] by weighting poverty gaps by rank income in the population as a whole:

$$TH(y;z) = H[S + 2(1-H)R] \tag{7}$$

[29] Thon's contribution is one of many which followed Sen's 1976 work, which in the interest of brevity we do not consider here.

such that a transfer from a poor person to a rich person must increase the index. Equipped with this knowledge Table 10 presents the values that these indices take when they were applied, on a North-South basis, to the HESA graduate income data for 2004/05.

Table 10: Graduate Poverty in the UK, 2004/05 [1, 2]

	Graduate Poverty in the **North**		Graduate Poverty in the **South**	
	50%	75%	50%	75%
Head Count (%)	0.80	3.42	1.60	6.8
Poverty Gap Ratio (%)	0.32	0.72	0.33	1.10
Sen index (%)	0.44	1.10	0.52	1.56
Gini (poor)	0.20	0.14	0.16	0.08
Thon index (%)	0.64	1.44	0.65	2.09
	Total Obs = 6,501		Total Obs = 9,165	

[1] Values for poverty indices based on an analysis of individuals by gross salary 6 months after graduation.

[2] The Poverty line is taken as a percentage of the median graduate income in each region.

The first feature to note, from this set of results, is that the South had a greater proportion of graduates who were poor than did the North, for every poverty line. At the highest poverty line 6.8% of graduates in the South were poor as compared to 3.4% for the North. For both North and South the Poverty Gap Ratio rose with the higher poverty line, markedly so in the South. The absolute value of the Poverty Gap Ratio was, at the higher poverty line, significantly higher in the South indicating that the depth of poverty was greater than in the North or,

in other words, graduates based in the South were more poor than their counterparts in the North. At the lower poverty line we note that whilst the South had more poor graduates than the North, the depth of poverty was virtually identical in both regions.

A comprehensive view of poverty, as discussed above in the context of Sen's (1976) paper, needs to incorporate – in addition to the percentage who are poor and their depth of poverty – the idea of relative deprivation, expressed in terms of the prevailing degree of inequality in the distribution of 'poor' incomes, that is, G^P. Interestingly, the values of the Gini index showed that there was a greater degree of inequality among the poor in the North than in the South, even though the South had greater numbers and depth of graduate poverty. However, looking at poverty in its totality, the lower value of G^P in the South was not enough to offset its disadvantage in terms of higher values of H and R; there was – judging by the Sen and Thon indices – 'less' graduate poverty in the North of the UK.

Section 4 presented an analysis by inequality decomposition based on the key variables of heterogeneity identified from the OLS regression of Section X, we continue now by considering the relative importance of these same influences on the aggregate level of graduate poverty in the UK. This investigation constitutes the topic of 'poverty decomposition' and its objective is to arrive at a quantitative assessment of the contribution which the various subgroups in the population made, in 2004/5, to overall poverty in the UK

In order to investigate the decomposability of aggregate poverty we wish to employ a poverty index that establishes a sensible relationship between

subgroup poverty and overall poverty. Primarily we seek an index which, firstly, sums the subgroup contributions to exhaust total poverty and, secondly, is sensitive to an increase in the poverty contribution of a subgroup. In the latter case an increase in the poverty contribution of a subgroup will, ceteris paribus, result in an increase in the overall poverty index. With this in mind we consider the suitability of the poverty index proposed by Foster, Greer and Thorbecker (1984), hereafter referred to as the FGT index.

Earlier we initiated an examination of poverty measures based upon the theoretical assumption that there existed a population of *N* individuals, with incomes y_i, i = 1,…, *N* arranged in ascending order, where M individuals had incomes equal to or less than the poverty line, z. Then the FGT index, is defined with respect to the vector of incomes y = (y_1,…,y_n), the poverty line, z, and a parameter α as:

$$FGT(y;z,\alpha) = \frac{\sum_{i=1}^{M}(z-y_i)^{\alpha}}{Nz^{\alpha}} \qquad (8)$$

As the value of the α parameter increases, the FGT(α) index encompasses successively broader concepts of poverty. When α=0, the value of the index is simply the head count ratio, as defined in equation (4) above. When α=1 the value of the index is generated as the product of the head count ratio and the poverty gap ratio, representing the average normalised poverty gap. FGT(1) captures both the proportion of the population who are poor and also the depth of their poverty. Finally, α=2:

$$FGT(y;z,2) = H[R^2 + (1-R)^2(CV_P)^2] \quad (9)$$

where CV_P is the coefficient of variation calculated over the distribution of poor incomes. Then the value of the index represents the average squared normalised poverty gap, and crucially it incorporates Sen's idea of 'relative deprivation', as measured by income inequality among poor individuals. The true merit of the FGT index, and indeed it's most attractive feature, is that it is decomposable, enabling us to express overall graduate poverty as the population-weighted average of the subgroup values:

$$FGT(y;\alpha) = \sum_{k=1}^{K} \Phi_k \quad (10)$$

Where $\Phi_k = N_k/N$ is the population share of group *k*. The proportionate contribution made by group *k* to overall poverty is then defined as:

(11)

Extending this methodology still further, we can identify subgroups that are particularly susceptible to poverty. We define the 'poverty risk' of population subgroup *k* as:

$$\rho_k = \frac{FGT(y_k;z,\alpha)}{FGT(y;z,\alpha)} = \frac{FGT(y_k;z;\alpha)C_k}{\phi_k FGT(y_k;z,\alpha)} = \frac{C_k}{\phi_k} \quad (12)$$

So, for example, if we analyse the graduate population by subject of study, where *k* represents mathematical science, then in line with equation (12) we can calculate the poverty risk of mathematical science graduates. The poverty risk is expressed as the ratio of the contribution to poverty that mathematical science

graduates make, to their contribution to the graduate population: $\rho_k > 1$ ($\rho_k < 1$) means that they contribute more (less) to poverty than their population share warrants.

If the norm for poverty risk is taken to be unity, then, say $\rho_k = 1.34$ means that the poverty risk for Mathematical Science graduates is 34% above the norm; similarly, $\rho_k = 0.84$ means that the poverty risk is 16% below the norm.

Poverty decompositions for UK graduate income are presented in Annex G [Tables 1 – 5]. The subgroups for which the decompositions were done are in following with the previous analysis, that is; region, subject, occupation, industry and, finally, institution-type. Using the 50% poverty line with the headcount ratio as the poverty measure, the key findings are presented in Table 11 below:

Table 11: Poverty Risk

	High Risk
Region	North
Subject	Agriculture
Occupation	Low Status
Industry	Distribution, Hotels & Restaurants
Institution-type	Other

The 'poverty risk', as defined by equation (12) was highest for graduates employed in the North of the UK, for those who studied Agriculture and for those in low status occupations within the 'Distribution, Hotel and Restaurant' Industry: their respective poverty risks were 13%, 207%, 68% and 69% above the norm.

Whilst Annex G [Table 5] shows that 'New' university graduates contributed to almost half of the total graduate poverty by Institution-type, after accounting for population shares the poverty risk for 'New' and 'Old' sector graduates was broadly equivalent; in both instances the risk was 3% below the norm.

6. Conclusion

In this paper, we have exploited individual-level HESA data for 2004/05 leavers from the UK university sector in order to investigate the determinants of graduate earnings. We have found that there are substantial variations in earnings according to: the degree subject studied, the region of employment and the occupation and industry of employment. We contend, therefore, that estimates of the average rate of return to a university degree, as cited, for example, by Blundell, Dearden, Goodman and Reed (2000)[30], are likely to conceal much variation about the average. Consequently, it is likely that there will be substantial differences across students in the expected rate of return to an undergraduate degree.

Among other results, we find that age, gender and domicile have a significant effect on graduate earnings, as does social background for females – though only moderately. Interestingly, we establish no causal relationship between pre-university qualifications and earnings variability. We show that there is large and significant variation in graduate earnings according to the degree classification awarded. For the average male graduate, the variation in earnings associated

[30] See page 4: Blundell *et al* estimate that there is a premium for a first undergraduate degree of approximately 17% for men and 37% for women.

with a first and those associated with a third are around 8%. For females the effect of degree classification is much weaker at around 3%. Given that degree classification is an *ex ante* outcome we can reasonably conclude that there must be considerable risk and uncertainty around the expected returns to a first undergraduate degree, particularly for males. After controlling for the heterogeneity of students, we find limited evidence that graduate earnings vary to any significant extent by the type of institution attended. These two findings lead us to express concern at the introduction of, from Sept 2006, differential top-up fees. We argue that, firstly, the significant variation around the average return for a first degree will expose itself in the form of rather lower expected returns for some students. Secondly, if it is only better off students who can afford to finance the cost of relatively risky investments in those university courses associated with relatively high earnings, then there is likely to be an adverse impact on equality of opportunity and intergenerational mobility over time. Whether the operation of income-related exemptions and allowances will be sufficient to off-set this effect remains to be seen.

Finally, this paper set out to uncover, through measurement, the structure of graduate inequality and deprivation in the United Kingdom, in its Northern and Southern divides and in its regions. We utilised the individual-level HESA data to discover that the level of graduate income inequality, amongst the 2004/05 cohort, was actually quite low. Whilst average graduate earnings were greater in the South of the UK, they were also more unequally distributed. Decomposing inequality by what we have called the themes of heterogeneity, that is, by region,

by university-type, by subject, by occupation and finally by industry we conclude that the substantial part of inequality is the result of within-group inequality and only a very small part is due to between-group inequality. So, for example, based on the Mean Logarithmic Index, for the UK as a whole, 92% of the inequality in incomes between graduates could be 'explained' by differences in the mean income within different degree subjects.

Deprivation was analysed in section 5. We set out a standard methodology from which various aggregate measures of (relative) graduate poverty were derived. Examining poverty by component we discovered that the South of the UK had a higher proportion of 'poor' graduates than the North (H), moreover, the mean income shortfall of the 'poor' expressed as a proportion of the poverty line (P) was greatest in the South of the UK. When we looked at the incomes of the 'poor' more closely we actually discovered that there was a greater incidence of income inequality amongst the poor in the North than in the South of the UK (S). However, looking at deprivation in totality, the lower value of S in the South was not enough to offset the disadvantage in terms of higher values of H and R; there was less graduate deprivation in the North of the UK.

There are a number of directions for further work. It would be interesting to replicate this analysis for previous university cohorts from the HESA files dating back to 1992/93[31], in particular to determine how the variation in earnings associated with the class of degree awarded and the subject studied have behaved over time. Secondly, the rich information collected by HESA is

[31] Prior to 1992/93 HESA published information in the form of the First Destinations Survey, which is not directly comparable with the subsequent DLHE Survey.

somewhat constrained by the fact that the DLHE survey collects salary information at a period approximately six months after graduation – effectively starting salary information. The obvious problem associated with collecting information so soon after graduation is that it is generally considered to be a poor reflection of career path. In order to address this problem HESA are currently undertaking a follow-up survey on a sample of 2002/03 leavers who responded to the 2002/03 DLHE survey. This follow-up survey at approximately three and a half years after graduation will provide a valuable source of longitudinal data with information more closely aligned to the early career trajectories of graduates. Longitudinal data for the 2004/05 cohort will be available from Spring 2009 and represents an exciting opportunity to supplement this paper.

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Annex A: JACS Subject Areas

The Higher Education Statistics Agency (HESA) has defined nineteen subject areas in terms of JACS codes for reporting information broken down by subject. These 19 subjects are further broken down across 143 Principle Subjects, so for example, within the subject area of Biological Sciences there are 9 principle subjects including amongst others Botany, Zoology and Genetics. The subject areas give a useful broad-brush picture, do not overlap and cover the entire range of JACS Principle Subjects.

Degree Subject	JACS code
Subjects allied to medicine	B
Biological sciences	C
Veterinary sciences	D1/2
agriculture & related subjects	D/0/3/4/5/6/7/9
Physical sciences	F
Mathematical sciences	G0/1/2/3/90/91/99
Computer sciences	G4/5/6/7/92
engineering & technology	H, J
architecture, building & planning	K
Social studies	L
Law	M
Business & administrative studies	N
Mass communication & documentation	P
languages	Q, R, T
Historical & philosophical studies	V
creative arts & design	W
Education	X
Combined	Y

Annex B

Mode of study

Full-Time includes full-time and sandwich study, plus those writing-up theses following full-time study.

Level of qualification obtained

Postgraduate qualifications are doctorate degrees, masters degrees, higher bachelor degrees, postgraduate diplomas and certificates, and PGCE.

First degrees are first degrees, first degrees with eligibility to register to practice (doctor/dentistry/veterinary surgeon), first degrees with qualified teacher status (QTS)/registration with the General Teaching Council (GTC), enhanced first degrees and first degrees obtained concurrently with diplomas

Other undergraduate qualifications are foundation degrees and all other higher education qualifications not included above which are within the scope of the DLHE return.

Reason for leaving

Unsuccessful completion includes, amongst others; exclusion, health reasons, exclusion, transfer to another institution and academic failure.

Subject

Medical students include those completing pre-clinical and clinical medicine and dentistry courses.

Labour market status

Employment only includes those graduates who reported that they were in full-time paid work (including self-employed/freelance), part-time paid work, and who were not in study, training or research.

Annex C: Average graduate earnings by JACS Principle Subject, (£/wk)

	FEMALES			MALES		
Degree Subject	Mean	Std. Dev	N	Mean	Std. Dev	N
Subjects allied to medicine	**361.29**	**83.11**	**4,805**	**363.5**	**122.84**	**766**
Anatomy, physiology & pathology	344.53	71.77	777	352.78	82.13	181
Pharmacology, toxicology & pharmacy	333.74	95.21	360	355.79	153.08	156
Complementary medicine	363.57	127.18	90	420.26	188.08	30
Nutrition	352.16	81.73	114	333.33	95.51	6
Ophthalmics	218.10	89.10	123	228.21	86.97	58
Aural & oral sciences	360.06	53.48	151	365.38	.	1
Nursing	381.39	77.42	2,077	414.43	112.97	128
Medical technology	378.77	60.54	347	394.38	69.21	68
Others in subjects allied to medicine	353.14	77.58	766	369.64	110.01	138
Biological sciences	**280.77**	**95.15**	**2,942**	**287.39**	**95.49**	**1,244**
Biology	281.15	91.18	464	289.24	91.80	211
Botany	250.00	67.99	5	284.62	141.42	2
Zoology	262.54	140.85	111	273.26	84.40	31
Genetics	281.78	73.06	67	263.05	71.71	14
Microbiology	271.69	86.17	68	310.34	116.49	29
Sports Science	275.55	75.49	341	284.48	92.03	479
Molecular biology, biophysics & biochemistry	324.99	93.17	157	291.60	98.23	80
Psycology	279.19	96.26	1,625	294.73	102.02	288

	FEMALES			MALES		
Degree Subject	Mean	Std. Dev	N	Mean	Std. Dev	N
Others in biological science	280.14	99.35	104	275.28	96.71	110
Veterinary sciences	**412.63**	**91.68**	**129**	**416.61**	**79.21**	**52**
Pre-clinical veterinary medicine & dentistry	374.75	72.07	39	457.69	119.63	5
Clinical veterinary medicine & dentistry	429.04	94.71	90	412.23	74.23	47
Agriculture & related subjects	**282.03**	**82.38**	**320**	**311.68**	**86.2**	**153**
Animal science	258.29	72.73	127	234.86	57.57	8
Agriculture & related subjects	274.87	90.39	93	313.95	79.16	100
Forestry	298.08	95.19	2	357.99	120.75	13
Food & beverage studies	323.08	70.71	85	324.92	79.59	24
Agriculture Sciences	346.15	.	1	221.15	95.18	2
Others in veterinary sciences, agr & related subjects	290.06	91.85	12	253.21	88.89	6
Physical sciences	**290.00**	**89.75**	**830**	**326.22**	**115.77**	**998**
Broadly based programmes within physical sciences	307.69	.	1	2	235.58	2
Chemistry	310.02	94.57	203	335.25	124.91	200
Materials science	346.15	.	1	423.08	.	1
Physics	322.40	108.71	51	357.93	138.86	200
Forensic & archaeological science	264.43	73.74	108	285.78	89.79	43
Astronomy	247.86	79.55	9	274.57	100.29	9
Geology	287.72	69.25	71	338.77	102.60	112
Ocean sciences	397.44	79.29	9	350.00	151.98	10
Physical & terrestrial geographical & env. sciences	280.89	88.04	368	308.84	99.18	411

	FEMALES			MALES		
Degree Subject	Mean	Std. Dev	N	Mean	Std. Dev	N
Others in physical sciences	276.71	83.79	9	290.38	101.54	10
Mathematical sciences	**343.93**	**114.57**	**223**	**383.27**	**186.33**	**297**
Mathematics	343.52	117.03	203	386.42	191.92	269
Operational research	284.62	58.33	5	301.28	76.92	9
Statistics	369.23	87.28	15	382.35	132.52	17
Others in mathematical sciences				336.54	95.19	2
Computer sciences	**342.39**	**201.79**	**522**	**363.04**	**130.72**	**2,398**
Computer science	325.93	117.36	339	361.49	123.98	1,725
Information systems	371.22	317.08	159	360.61	157.70	438
Software engineering	383.85	133.18	24	386.63	122.72	227
Artificle intelligence				416.67	109.35	3
Others in computing science				459.62	125.81	5
Engineering & Technology	**358.03**	**114.15**	**400**	**382**	**177.91**	**2,249**
General engineering	360.68	133.09	49	431.0307	408.42	258
Civil engineering	369.35	77.69	63	387.7459	74.77	355
Mechanical engineering	395.75	116.17	38	385.8882	98.22	509
Aerospace engineering	353.94	89.46	21	383.7223	121.10	184
Naval architecture				299.2789	79.13	16
Electronic and electrical engineering	351.95	101.23	68	361.6836	127.46	517
Product and manufacturing engineering	351.61	150.26	37	355.9283	118.83	133
Chemical, process & energy engineering	461.85	90.15	31	431.6387	100.56	94

	FEMALES			MALES		
Degree Subject	Mean	Std. Dev	N	Mean	Std. Dev	N
Others in engineering	342.95	184.62	6	350.2747	61.82	14
Mineral technology				288.4615	27.20	2
Metallurgy						
Ceramics & glasses						
Polymers & textiles	305.42	68.89	34	326.92	.	1
Materials technology not elsewhere specified	276.71	125.87	18	381.05	262.65	27
Maratime technology	375.00	95.19	2	349.76	109.01	16
Industrial biotechnology				269.23	.	1
Others in technology	314.13	94.67	33	340.79	178.56	122
Architure, building & planning	**340.16**	**126.60**	**220**	**371.31**	**116.98**	**636**
Architecture	301.25	81.38	114	329.12	97.74	257
Building	414.87	194.06	49	407.93	96.13	259
Landscape design	317.31	84.19	10	313.87	58.86	14
Planning (urban, rural & regional)	361.83	96.31	46	388.64	171.51	98
Others in architecture, building & planning	346.15	.	1	429.09	88.57	8
Social studies (8)	**321.39**	**105.92**	**2,227**	**355.63**	**142.88**	**1,414**
Broadly based programmes within Social Studies	213.03	111.68	4			
Economics	379.70	154.30	228	408.90	170.02	513
Politics	312.50	97.10	217	336.83	114.13	254
Sociology	287.82	80.27	621	310.58	133.69	168
Social Policy	296.39	83.28	106	324.27	153.63	29

	FEMALES			MALES		
Degree Subject	Mean	Std. Dev	N	Mean	Std. Dev	N
Social work	380.88	95.85	515	423.30	83.39	92
Anthropology	287.74	90.62	81	299.60	96.65	19
Human & Social geography	293.44	85.81	353	297.99	93.57	289
Others in social studies	267.69	83.93	102	304.23	77.48	50
Law	**295.57**	**95.10**	**676**	**327.15**	**162.03**	**326**
Broadly based programmes within Law	322.44	102.10	30	326.92	133.23	18
Law by area	316.95	113.83	186	344.81	152.72	97
Law by topic	288.44	86.05	422	321.27	170.08	205
Others in Law	248.88	45.61	38	243.59	53.94	6
Business & administrative studies	**314.90**	**124.34**	**3,448**	**340.37**	**137.05**	**2,568**
Broadly based programmes within Bus & Admin Studies	326.37	73.97	35	363.36	188.96	19
Business studies	322.52	122.70	1,619	349.77	150.96	1,382
Management Studies	312.09	129.16	595	328.98	120.92	462
Finance	374.57	155.42	45	375.07	146.01	81
Accounting	301.08	104.19	204	313.20	102.51	278
Marketing	314.30	72.64	367	329.69	96.46	204
Human Resource Management	334.50	91.10	137	351.98	137.02	24
Tourism, transport & travel	284.51	165.39	423	314.26	121.75	94
Others in business and administration	290.55	96.24	23	379.01	136.04	24
Mass communication & documentation	**283.87**	**77.51**	**957**	**283.49**	**91.62**	**500**
Information services	302.75	110.60	29	298.53	95.69	21

	FEMALES			MALES		
Degree Subject	Mean	Std. Dev	N	Mean	Std. Dev	N
Publicity studies	311.60	76.02	131	299.24	95.97	33
Media studies	277.27	70.02	566	283.46	95.62	329
Publishing	284.54	74.20	33	270.60	78.47	14
Journalism	282.56	93.91	161	274.38	77.35	89
Others in mass communication & documentation	277.01	65.53	37	295.33	78.97	14
languages	**287.19**	**97.52**	**1,482**	**293.61**	**116.84**	**422**
Linguistics, classics & related subjects	280.45	94.48	1,068	286.58	115.97	288
European languages, literature & related subjects	310.32	105.65	268	309.07	119.15	77
Asian studies	330.42	112.07	11	349.65	130.94	11
Eastern, Asiatic, African, American & Australasian studies	287.96	96.44	135	298.37	112.45	46
Historical & philosophical studies	**293.79**	**111.27**	**911**	**301.26**	**147.67**	**721**
Broadly based programmes within Historical & …	221.15	.	1			
History by period	294.72	94.26	527	297.72	120.13	485
History by area	342.31	93.62	5	326.92	176.25	3
History by topic	304.33	171.44	139	350.04	272.49	52
Archaeology	255.84	88.56	44	252.88	72.47	43
Philosophy	302.97	98.22	91	312.09	187.27	83
Theology & religious studies	284.69	108.73	87	306.39	172.76	51
Others in Historical & Philosophical Studies	264.17	97.99	17	307.69	107.65	4
Creative Arts & Design	**263.29**	**97.38**	**2,410**	**291.93**	**185.48**	**1,463**
Fine art	234.87	86.72	274	241.07	93.49	99

	FEMALES			MALES		
Degree Subject	Mean	Std. Dev	N	Mean	Std. Dev	N
Design studies	268.91	94.66	1,183	306.52	205.72	750
Music	268.13	110.01	185	285.34	204.58	214
Drama	262.73	87.39	419	280.16	127.17	152
Dance	257.11	99.68	48	269.23	108.79	2
Cinematics & photography	269.93	133.51	182	281.86	168.43	188
Crafts	225.23	87.44	33	206.09	78.26	6
Imaginative writing	280.45	73.55	12	243.10	81.53	19
Others in Creative Arts & Design	271.40	89.01	74	312.06	104.26	33
Education	**345.24**	**94.85**	**1,211**	**349.8**	**247.45**	**183**
Training teachers	369.83	58.68	889	402.89	312.76	102
Research & study skills in education	250.00	30.41	5	258.63	47.93	14
Academic studies in education	280.69	152.41	225	311.74	118.30	19
Others in Education	270.74	80.57	92	278.45	80.62	48
Combined	**266.94**	**90.77**	**142**	**296.25**	**93.13**	**51**
Total	**313.41**	**108.51**	**23,855**	**339.59**	**148.04**	**16,441**

Source: HESA

Annex D: Degree Classification (%) by Higher Education Institution Type

	FEMALE		MALE	
	CLASS			
	1	3	1	3
Old	13.5	1.8	15.1	4.1
New	9.5	3.4	10.5	5.1
Russell	14.9	1.7	18.6	3.2
Other	9.0	2.5	8.6	6.4

Source: HESA

Annex E: Average regional Prices Relative to National Average Price (UK=100)

	Excluding Housing Costs	Including Housing Costs
Wales	96.5	93.1
Scotland	98.0	94.5
Northern Ireland	100.9	95.8
North East	96.1	94.2
North West	98.4	96.9
Yorks/Humber	95.9	94.2
East Midlands	97.8	97.4
West Midlands	98.2	97.8
East	99.6	101.1
London	107.1	109.7
South East	101.6	105.3
South West	100	101.3

Source: ONS Regional Trends

Annex F: Share of Graduate Employment by Region

	MEN			WOMEN		
	% of workforce	% of graduates	Ratio+	% of workforce	% of graduates	Ratio+
North East	3.9%	4.5%	1.17	4.0%	4.5%	1.10
Yorks & Humber	8.3%	8.6%	1.04	8.3%	8.5%	1.03
East Midlands	7.4%	6.7%	0.90	7.4%	7.0%	0.95
Eastern	9.6%	7.1%	0.74	9.3%	7.3%	0.78
London	12.9%	20.4%	1.59	12.2%	18.5%	1.52
South East	14.3%	12.9%	0.90	14.3%	12.6%	0.88
South West	8.5%	8.4%	0.99	8.6%	7.9%	0.91
West Midlands	8.9%	7.8%	0.88	8.5%	8.2%	0.96
North West	10.8%	10.1%	0.94	11.3%	10.0%	0.89
Wales	4.5%	4.3%	0.95	4.7%	4.6%	0.98
Scotland	8.4%	7.1%	0.84	8.8%	8.5%	0.97
N.Ireland	2.7%	2.2%	0.83	2.6%	2.5%	0.97

Source: LFS – 2005(Q4)
http://www.statistics.gov.uk/onlineproducts/lms_hqs.asp
DLHE 2004/2005

Annex G: Analysis by Inequality Decomposition

Table 1: The Regional Divide in Graduate Income in 2005 - values of inequality indices based on analysis of individuals by gross weekly income.

	North	South	Peripheral	Centre	South excl. Gr. London	Gr.London
Observations	6,501	9,165	1,850	5,965	4,736	3,115
Mean Income	287.41	327.99	286.15	288.57	305.47	377.87
Population Share	41.5	58.6	11.8	38.1	30.2	19.9
Income Share	38.3	61.7	10.9	35.3	29.7	24.1
Relative Mean	0.92	1.05	0.92	0.93	0.98	1.21
GE(0)	0.04	0.05	0.0386	0.04	0.04	0.05
GE(1)	0.04	0.04	0.0372	0.04	0.04	0.06
Gini	0.1497	0.1688	0.1495	0.1508	0.1481	0.1734

Source: Own calculations from HESA data

Annex G: Analysis by Inequality Decomposition cont'd

Table 2: The Subject Divide in Graduate Income in 2005 - values of inequality indices based on analysis of individuals by gross weekly income.

	Observations	Mean Income	Pop Share	Income Share	Relative Mean	Gini
Subjects allied to medicine	1,688	351	11	12	1.13	0.11
Biological sciences	2,098	283	13	12	0.91	0.14
Agriculture & related subjects	175	277	1	1	0.89	0.15
Physical sciences	741	293	5	4	0.94	0.15
Mathematical sciences	204	357	1	1.5	1.15	0.19
Computer sciences	802	349	5	6	1.12	0.17
Engineering & Technology	422	339	3	3	1.09	0.17
Architure, Building & Planning	235	334	2	2	1.07	0.15
Social studies	1,845	330	12	12	1.06	0.18
Law	512	304	3	3	0.98	0.16
Business & administrative studies	1,802	316	12	12	1.01	0.16
Mass communication & documentation	787	288	5	5	0.93	0.13
languages	839	289	5	5	0.93	0.15
Historical & philosophical studies	970	303	6	6	0.97	0.18
Creative arts & design	1,794	276	11	10	0.89	0.16
Education	661	356	4	5	1.14	0.11
Combined	91	268	<1	<1	0.86	0.13

Annex G: Analysis by Inequality Decomposition cont'd

Table 3: The Occupational Divide in Graduate Income in 2005 - values of inequality indices based on analysis of individuals by gross weekly income

	Observations	Mean Income	Pop Share	Income Share	Relative Mean	Gini
Managers & Senior Officials	1,328	347	8.5	9.4	1.11	0.18
Professionals	2,597	357	16.6	19.0	1.15	0.15
Associate Professional & Technical	5,772	337	36.8	40.0	1.08	0.15
Administrative & Secreterial	3,222	270	20.6	17.9	0.87	0.12
Skilled Trade	141	284	1.0	0.8	0.91	0.17
Personal Service	832	239	5.0	4.1	0.77	0.14
Sales and Customer Service	1,356	246	8.7	6.9	0.79	0.13
Process , Plant and Machinery	84	270	0.5	0.5	0.86	0.16
Elementary Occupations	334	228	2.1	1.6	0.73	0.14

	Observations	Mean Income	Pop Share	Income Share	Relative Mean	Gini
High Status Occupations	9,697	344	61.9	68.4	1.1	0.1528
Low Status Occupations	5,969	258	38.1	31.6	0.83	0.1293

Source: Own calculations from HESA data

Annex G: Analysis by Inequality Decomposition cont'd

Table 4: The Industrial Divide in Graduate Income in 2005 - values of inequality indices based on analysis of individuals by gross weekly income

	Observations	Mean Income	Pop Share	Income Share	Relative Mean	Gini
Agri_Energy_Manuf_Construction	1,630	315	10.4	10.5	1.01	0.1456
Distribution_Hotels_Restaurants	2,014	267	12.9	11	0.86	0.1643
Transport_Communications	530	305	3.4	3.3	0.98	0.1621
Banking_Finance_Insurance	4,777	326	30.5	32	1.05	0.1798
Public admin_Education_Health	5,605	318	35.8	36.5	1.02	0.1443
Other Services	1,110	291	7.1	6.6	0.94	0.1662

Source: Own calculations from HESA data

Annex G: Analysis by Inequality Decomposition cont'd

Table 5: The Institutional Divide in Graduate Income in 2005 - values of inequality indices based on analysis of individuals by gross weekly income.

	Observations	Mean Income	Pop Share	Income Share	Relative Mean	Gini
Russell	3,794	308	24.2	24.0	0.99	0.1632
Old	5,786	304	48.4	47.4	0.98	0.1553
New	3,613	329	23.1	24.4	1.06	0.1836
Other	642	309	4.1	4.1	0.99	0.1668

Source: Own calculations from HESA data

Annex H: Deprivation Analysis

The decomposition of graduate poverty in the UK, FGT(α) x 100 [Table 1]

By Region

	α = 0		α = 1		α = 2	
	1/2 median income	2/3 median income	1/2 median income	2/3 median income	1/2 median income	2/3 median income
Overall Poverty	1.1	3.1	0.3	0.8	0.2	0.3
Contribution to overall poverty by region (%)						
North [41.5]	46.9	48.3	49.3	48.3	52.3	49.7
South [58.5]	53.1	51.7	50.7	51.7	47.7	50.3
Peripheral [11.8]	15.4	16.2	14.3	15.0	13.1	14.1
Central [38.1]	38.3	43.2	41.3	42.1	46.0	42.9
South excl Gr London [30.2]	35.4	31.0	32.7	32.5	29.7	32.0
Gr. London [19.9]	10.9	9.5	11.8	10.4	11.3	11.0

Figures in [] represent population shares

Source: Own calculations from HESA data

Annex H: Deprivation Analysis cont'd

The decomposition of graduate poverty in the UK, FGT(α) x 100 [Table 2]

By Degree Subject

	α = 0		α = 1		α = 2	
	1/2 median income	2/3 median income	1/2 median income	2/3 median income	1/2 median income	2/3 median income
Overall poverty	1.1	3.1	0.3	0.8	0.2	0.3
Contribution to overall poverty by subject (%)						
Subjects allied to medicine [10.8]	3.4	10.5	5.3	6.7	6.8	5.8
Biological Sciences [13.4]	14.9	17.4	9.5	14.2	6.6	10.7
Agriculture & related subjects [1.1]	3.4	2.8	2.6	3.2	3.0	3.1
Physical sciences [4.7]	5.1	4.3	4.0	4.4	3.7	4.2
Mathematical sciences [1.3]	1.1	1.0	0.8	0.9	0.3	0.7
Computer sciences [5.1]	2.3	2.0	2.6	2.3	2.9	2.6
Engineering & Technology [2.7]	1.1	1.4	1.3	1.3	0.8	1.1
Architure, Building & Planning [1.5]	0.0	0.6	0.0	0.4	0.0	0.2
Social studies [11.8]	10.3	7.7	12.1	9.5	13.9	11.5
Law [3.3]	2.3	2.2	0.5	1.7	0.1	1.0
Business & administrative studies [11.5]	3.4	5.7	3.9	4.9	4.8	4.5
Mass communication & documentation [5.0]	2.9	4.1	4.6	4.0	6.1	4.7

languages [5.0]	8.6	6.7	5.5	6.6	3.8	5.6
	α = 0		α = 1		α = 2	
	1/2 median income	2/3 median income	1/2 median income	2/3 median income	1/2 median income	2/3 median income
Historical & philosophical studies [6.2]	10.3	7.9	10.6	9.4	11.1	10.4
Creative arts & design [11.5]	28.0	21.7	34.7	27.5	35.0	31.8
Education [4.2]	2.3	2.8	1.6	2.5	1.0	1.8
Combined [0.6]	0.6	1.0	0.4	0.6	0.1	0.4

Figures in [] represent population shares

Source: Own calculations from HESA data

Annex H: Deprivation Analysis cont'd

The decomposition of graduate poverty in the UK, FGT(α) x 100 [Table 3]

By Occupation

	α = 0		α = 1		α = 2	
	1/2 median income	2/3 median income	1/2 median income	2/3 median income	1/2 median income	2/3 median income
Overall poverty	1.1	3.1	0.3	0.8	0.2	0.3
Contribution to overall poverty by occupation (%)						
High Status occupations [61.9]	36.0	34.1	48.0	37.8	52.4	44.4
Low ststus occupations [38.1]	64.0	65.9	52.0	62.2	47.6	55.6

Figures in [] represent population shares

Source: Own calculations from HESA data

Annex H: Deprivation Analysis cont'd

The decomposition of graduate poverty in the UK, FGT(α) x 100 [Table 4]

By Industry

	α = 0		α = 1		α = 2	
	1/2 median income	2/3 median income	1/2 median income	2/3 median income	1/2 median income	2/3 median income
Overall poverty	1.1	3.1	0.3	0.8	0.2	0.3
Contribution to overall poverty by Industry (%)						
Agri_Energy_Manuf_Construction [10.4]	3.4	5.5	2.9	4.3	3.1	3.5
Distribution_Hotels_Restaurants [12.9]	21.7	28.8	16.0	23.5	12.1	18.0
Transport_Communications [3.4]	0.6	2.6	1.7	2.2	2.6	2.1
Banking_Finance_Insurance [30.5]	16.0	13.0	19.4	15.5	21.6	18.3
Public admin_Education_Health [35.8]	41.4	38.5	35.6	37.6	32.7	35.8
Other Services [7.1]	17.1	11.6	24.6	16.9	27.9	22.2

Figures in [] represent population shares

Source: Own calculations from HESA data

Annex H: Deprivation Analysis cont'd

The decomposition of graduate poverty in the UK, FGT(α) x 100 [Table 5]

By Higher Education Institution Type

	α = 0		α = 1		α = 2	
	1/2 median income	2/3 median income	1/2 median income	2/3 median income	1/2 median income	2/3 median income
Overall poverty	1.1	3.1	0.3	0.8	0.2	0.3
Contribution to overall poverty by Institution (%)						
Russell [23.1]	21.7	18.5	24.8	20.8	26.7	23.6
Old [24.2]	23.4	28.6	21.0	24.7	20.5	22.2
New [48.4]	46.9	46.2	42.9	46.1	40.1	43.8
Other [4.1]	8.0	6.5	11.3	8.4	12.7	10.4

Figures in [] represent population shares

Source: Own calculations from HESA data

Annex I

Post-1992 ‘Modern’ HEIs

university college chester
canterbury christ church university
york st john college
edge hill college of HE
the university of winchester
liverpool hope university
university of the arts, london
university of luton
university college northampton
roehampton university
southampton solent university
st martin's college
university college worcester
anglia polytechnic university
bath spa university college
bolton institute of he
bournemouth university
the university of brighton
the university of central england in birmingham
the university of central lancashire
university of gloucestershire
coventry university
university of derby
the university of east london
university of greenwich
university of hertfordshire
the university of huddersfield
the university of lincoln
kingston university
leeds metropolitan university
liverpool john moores university
the manchester metropolitan university
middlesex university
de montfort university
the university of northumbria at newcastle
the nottingham trent university

oxford brookes university
the university of plymouth
the university of portsmouth
sheffield hallam university
london south bank university
staffordshire university
the university of sunderland
the university of teesside
thames valley university
university of the west of england, bristol
the university of westminster
the university of wolverhampton
university of wales, newport
university of wales institute, cardiff
university of glamorgan
university of abertay dundee
the robert gordon university
the university of paisley
glasgow caledonian university
napier university
london metropolitan university

Pre-1992 'Old' HEIs

the open university
cranfield university
central school of speech and drama
royal academy of music
university of wales, newport
trinity college, carmarthen
aston university
the university of bath
the university of bradford
brunel university
city university
university of durham
the university of east anglia
the university of essex
the university of exeter

the university of hull
the university of keele
the university of kent
the university of lancaster
the university of leicester
Birbeck college
Goldsmiths college
institue of education
London Business School
London school of hygene & tropical medicine
Queen Mary and westfield college
Royal holloway and bedford new college
the royal veterinary college
St. George's hospital medical school
the school of oriental and african studies
the school of pharmacy
university of london (institutes and activities)
loughborough university
the university of reading
the university of salford
the university of surrey
the university of sussex
the university of york
the university of strathclyde
the university of aberdeen
heriot-watt university
the university of dundee
the university of st andrews
the university of stirling
the university of wales, lampeter
university of wales, aberystwyth
university of wales, bangor
university of wales swansea
university of ulster
the university of wales, registry
the university of buckingham

Russell Group

University of Birmingham
University of Bristol
University of Cambridge
University of Leeds
University of Liverpool
Imperial College of science, technology and medicine
King's College London
London School of Economics & Political Science
University College London
the university of newcastle upon tyne
University of Nottingham
University of Oxford
University of Sheffield
University of Southampton
University of Warwick
University of Edinburgh
University of Glasgow
Cardiff University
Queen's University Belfast
University of Manchester

Other HEIs

royal college of art
the royal college of nursing
bishop grossesteste college
Buckinghamshire chilterns university college
college of st mark and st john
dartington college of arts
university college of falmouth
harper adams university college
homerton college
kent institute of art and design
newman college of higher education
ravensbourne college of design and communication
rose bruford college
royal college of music

royal northern college of music
st mary's college
trinity and all saints college
trinity college of music
the surrey institute of art and design , university college
university college chichester
wimbeldon school of art
The north east wales inst of HE
swansea institute of HE
edinburgh college of art
glasgow school of art
queen margaret university college, edinburgh
the royal scottish academy of music and drama
scottish agricultural college
royal welsh college of music and drama
writtle college
norwich school of art and design
northern school of contemporary dance
cumbria institute of the arts
stranmillis university college
st. mary's university college
royal agricultural college
uhi millenium institute
the arts institute at bournmouth
bell college
conservatoire for dance and drama
Birmingham college of food, tourism and creative studies
Courtauld institude of art

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